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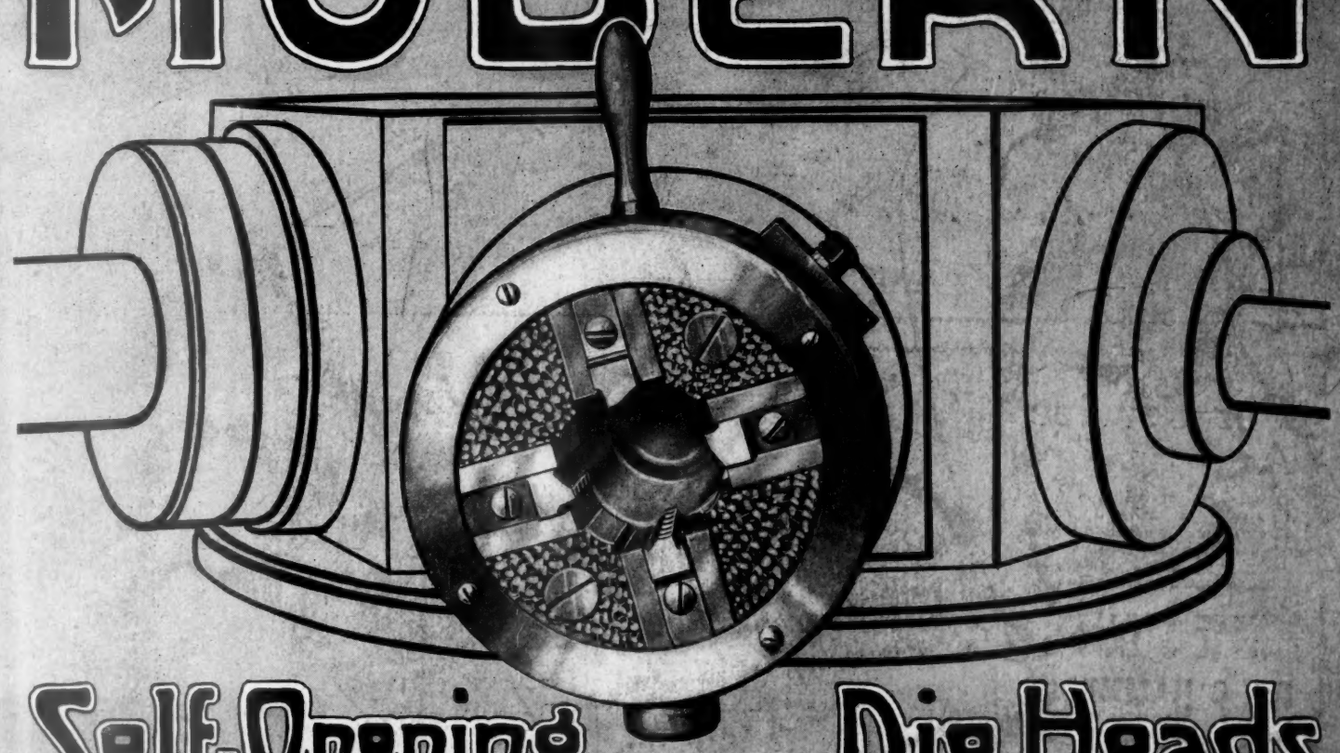
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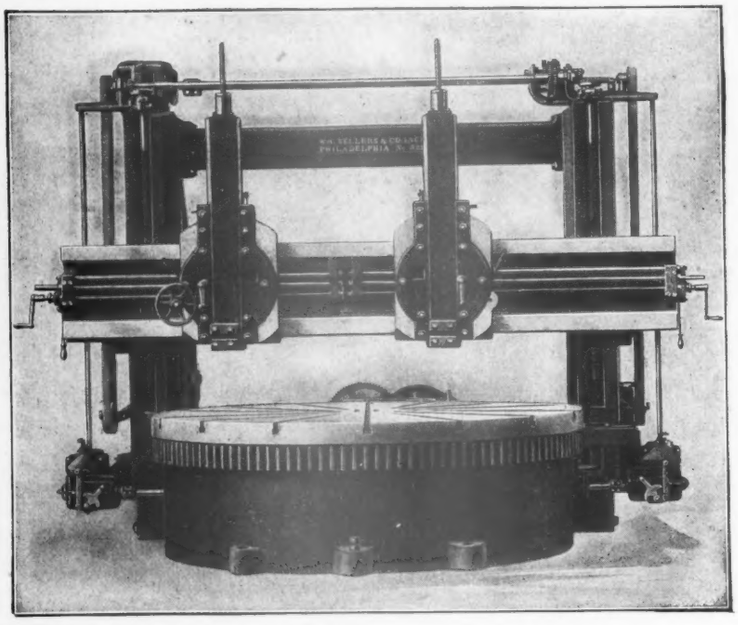
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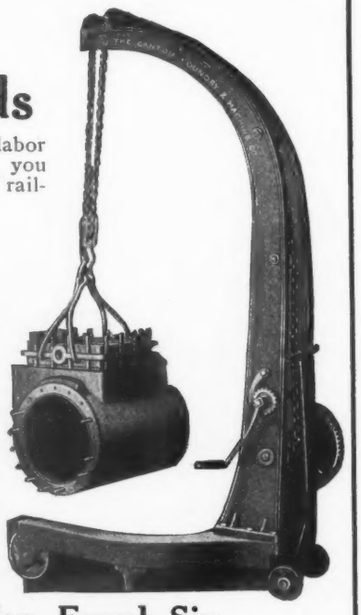
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Railway Mechanical Engineer

Volume 90 September, 1916 No. 9

Strike Hastens Publication

Publication of this issue was rushed when it became evident early in the last week of August that a general railroad strike was imminent. It was feared that if publication was deferred until the usual time the entire issue might be held up in the mails for an indefinite period. Because of this hurried publication it was impossible to include very much of the proceedings of the convention of the International Railway General Foremen's Association, although we had made special arrangements to publish a full account of it in this issue. The remainder of the proceedings of this meeting will be fully covered in our October number. Meanwhile complete accounts of the annual conventions of the International Railroad Master Blacksmiths' Association and the American Railway Tool Foremen's Association will be found in this number. As noted elsewhere, the annual convention of the Traveling Engineers' Association has been postponed indefinitely. Just what action will be taken by the Master Car and Locomotive Painters' Association, which is scheduled to hold its annual meeting at Atlantic City, September 12-14, and the Chief Interchange Car Inspectors' and Car Foremen's Association, which is to meet in Indianapolis, Ind., October 3-5, will, of course, depend upon later developments. The present crisis may be regarded as one of the most serious periods in the progress of our railways, as well as in the history of the nation, and it will be necessary for every loyal railway officer and employee to do his utmost to bring it to a satisfactory conclusion.

An Opportunity for Boosters

The *Railway Mechanical Engineer* has used its influence freely and fully toward the upbuilding and strengthening of railway mechanical department associations. It has done this with the knowledge that the members who attended the meetings of these organizations—and therefore the roads which they represent—would be greatly benefited thereby. Its editors could give remarkable instances of the increased efficiency and effectiveness of men who have been inspired and instructed by attending the conventions. In order to place on record convincing testimony as to the benefits derived from membership in different railway mechanical associations we want to secure data concerning specific instances of improvement. These testimonies or contributions should be brief, practical and to the point. Actual details of improvement or progress which have been made should be given as far as possible. The letters should not be more than 750 words in length and must be received at our office in the Woolworth building not later than November 1, 1916. Prizes of $15 will be awarded for each of the three best articles; others will be paid for according to our regular rates. Here is a splendid opportunity to testify concerning the practical benefits which you have received from your association. It may encourage your higher officers to continue sending you to the meetings and may induce others to attend. If the higher officers generally realized the possibilities of these meetings to the extent that some few do they would not only encourage their subordinates to attend, but would order them to do so and see that their expenses were paid.

Clearance Diagrams for Passenger Cars

Most roads follow the practice of making clearance diagrams for locomotives; this practice can profitably be extended to the passenger train cars. On a certain railway a derailment occurred on one of the double track lines in a rather congested part of a city. The conditions were such that by throwing the outside track out, traffic could be continued. The buildings in the vicinity of this point were built so close to the track that a question arose as to whether there was sufficient clearance for the cars in the train that was about due. A reference to the clearance diagrams showed just what changes would be necessary to permit the train to pass with safety. This use of the diagrams not only avoided some delay, but also prevented any damage to the equipment. Another use to which such diagrams can be put is in determining upon what equipment can be sent out on foreign lines. This is of special importance at this time in connection with the movement of troops. The diagrams can be made in a concise form so as to be easily carried and referred to.

Fuel Economy vs. Boiler Maintenance

Our fuel economy engineers are constantly advocating closing the fire door between each shovel full of coal fired, the reason for which is to prevent an undue amount of cold air entering the firebox, thus cooling the fire and—their second reason—cooling the firebox sheets and tube sheets, with the accompanying deleterious effects. We believe that the second reason should come first, for the effect of the cold air on the firebox sheets is far more expensive than the waste in fuel caused by cooling the fire. Maybe the fuel men think the same thing, but how many times do we see a fireman trying to prevent his engine from popping by opening this very same door to cool the fire? On the road, keeping the fire door closed is a hard and fast rule. If the engine pops the injectors are opened, and if the boiler is full the engine is allowed to pop, and no attempt is made to save the coal at a sacrifice of the tube and firebox sheets. This is one of the little things that the fuel engineer might easily overlook, and he needs only to confer with his confrere, the chief boiler inspector, to find out how important it is.

Railroad Clubs Falling Down

It is unfortunate that a number of railroad clubs are falling down badly on the programs for their meetings. A strong, wide-awake subjects committee, which would plan the meetings for the entire year and would then use the various means at its disposal for securing the very best men to present the papers, and properly coach them, could do much to brace up these clubs and make them a real

force in the various districts in which they are located. Some idea of what can be accomplished by the display of a little real energy can be seen in the progress which was made by the Western Railway Club last year. It is unfortunate that the New York Railroad Club, with its wonderful facilities and strength in both membership and finances, should fall so far short of its opportunities. There is no reason why it should not be a real power in the railroad field because of the value and importance of the papers which might be presented before it and the discussions which could be provoked. Few railroad or technical associations have such a wealth of material available and such a good vehicle for bringing it out, and yet the greater number of its meetings are of a very mediocre type.

Locomotive Boiler Efficiency

In another part of this issue will be found the first installment of an article by J. T. Anthony dealing with locomotive boiler efficiency. The remaining part of the article will be published in an early issue. The author is well known in railway circles in this country and has given much study and investigation to matters pertaining to the improvement of the locomotive boiler. It is of particular interest to note the discussion of the effect of moisture in coal. There is a general idea that when coal is wet it burns better. Mr. Anthony takes direct issue with this assumption. Special attention is also called to the comments on tube heating surface, as well as the discussion of the length and diameter of tubes. While the present day locomotive is a remarkably efficient machine, there is still room for improvement. Firebox efficiency can be increased by using large grates, and providing longer combustion chambers and devices tending to mix the gases. The author points out that at present both grates and combustion chamber space are being forced beyond their capacity, while neither firebox nor tube heating surfaces are being used to their capacity. The diagrams will be found of great assistance in studying this article and the entire discussion should prove of the utmost value to railway mechanical department men. The article is in two installments, and the second one will be published in an early issue. The foregoing gives a few of the conclusions reached by the author, these being summarized in the conclusion.

Hot Boxes on Freight Cars

What causes hot boxes on freight cars? How may they be eliminated? Some claim that the greater proportion of hot boxes is caused by mechanical defects; others claim that carelessness and neglect on the part of the employees is responsible for most of the trouble. What are these mechanical defects and how may they be remedied? How can the employees be educated and inspired to perform their duties properly? It has been said that 90 per cent of all the oil in journal boxes is wasted. If this is so, how may it be conserved and used to the best advantage in the prevention of hot box troubles? These questions are merely suggestive of the different phases of the hot box question which we hope different contributors will discuss in the competition on Hot Boxes on Freight Cars which was announced in our August issue and which will close on October 1. We do not mean to infer that each contestant should discuss all of these phases of the question; rather is it our purpose to encourage each individual who has had experience in studying and helping to solve the problem to discuss that part with which he is most familiar and towards the solution of which he can advance the most practical suggestions. The best three letters, not to exceed 750 words in length and accompanied by such sketches or photographs as may be necessary, will be awarded prizes of $15 each. Those contributions which are not awarded a prize, but which are published, will be paid for at our regular rates. The judges will base their decision upon the practical value of the suggestions which are made. The contributions must be received at the offices of the *Railway Mechanical Engineer* in the Woolworth building, New York, not later than October 1.

Passenger Car Windows

When the men who conduct the joke columns in the daily papers run short of material they frequently fall back on the passenger car window and its tendency to stay shut at all times and under whatever treatment. It is therefore a relief to learn recently of a number of cases in modern car equipment in which the proceeding is entirely reversed. The locking apparatus in such cases is out of order and the windows positively refuse to stay shut, which condition makes matters interesting for the passengers, particularly when the train is passing through a rainstorm. But setting aside the daily papers' ideas of the car window, it is unfortunately true that a great many of them are a source of annoyance. It is an hourly occurrence on almost any railroad for passengers either to have difficulty in raising a window or to find that it is impossible to open one at all. A great many of the latching and lifting mechanisms are far from satisfactory, and some of the weather stripping seems to be designed with the sole purpose of supplying so much frictional resistance to the movement of the window as to make it impossible of opening with anything short of a jimmy. The condition mentioned above, of windows opening practically of their own accord, is not the usual one; but to anyone who travels to any great extent, windows which are difficult or impossible to open are nothing new. There is a great deal of justification in the complaints of the traveling public regarding window conditions in the average passenger equipment, and there is room for much improvement in the application of fastenings and weather stripping to make the windows so that they can be easily opened by passengers and so that they will at the same time remain storm proof when closed.

The Successful Officer

As a foreman or officer how do you approach your work? You may have few or many men under you. To produce results you must work through them. They may be of many different types and minds, but you, by your personality, have got to inspire and educate them to direct their energies to the best possible advantage. Too many supervising officers take a narrow and superficial view of their responsibilities and possibilities. They tie themselves up with so much detail and take so intense an interest in their own detail performance that they lose the broad aspect which is so necessary in supervising the work of others. They lose sight of the future because their noses are kept at the grindstone of the present. They will spend time and energy on some problem which will give an immediate return that may be measured in dollars and cents and never see the big thing, the neglect of which may cost their employers hundreds of thousands of dollars a few years hence. True, the managements often wink at this practice because they are more interested in making an immediate showing than of taking the chances of sowing where others may reap in the future. It is this shortsighted attitude that is responsible for the neglect and lack of interest in the apprentice problem and the development of means for properly selecting and developing men. It is this lack of foresight which has placed the emphasis on the conservation and efficient use of materials and at the same time has almost overlooked the human element, the proper handling of which can save dol-

lars, whereas the better use of materials may only save cents, or even mills.

An Important Car Department Convention

The Master Car Builders' and the American Railway Master Mechanics' Associations consider and pass upon the larger and more important problems of the mechanical department. A considerable number of minor mechanical department associations discuss the detail problems with which they are concerned; the time is surely coming when these organizations will be more closely allied with the larger ones, thus greatly improving their effectiveness and possibilities. Most of these minor associations, with one exception, are largely concerned with the work of the locomotive department and touch only to a slight extent and largely incidentally on car department problems. The exception is the Chief Interchange Car Inspectors' and Car Foremen's Association, which, although it has been growing rapidly in strength in recent years, has not as yet achieved a place to which its work rightly entitles it. Its leaders, however, realize that because of the fact that its members are on the firing line and are intimately acquainted with all the details of the work handled by the car department it can become a most important adjunct to the Master Car Builders' Association. With this in mind they have arranged to broaden its activities by interesting more of the members of the car department and at the same time concentrating upon the solution of the larger and more troublesome questions which confront them. That they are on the highway to success in their efforts is indicated by the program for the annual meeting which is to be held next month at Indianapolis, Ind.

Of special interest is the unique competition on car department apprenticeship. Considering the efforts which have been made to develop an effective car department apprentice system on several roads, and the fact that the members of this association are practical men, thoroughly acquainted with the detail conditions under which the work of the car department is carried on, it would seem that the individual members of the association would be in position to make some splendid suggestions looking toward more rational methods for recruiting its ranks, and that these suggestions, after thorough study and discussion, could be formulated and referred to the Master Car Builders' Association as recommended practice. While the members of the Master Car Builders' Association have discussed this question a number of times they have never gotten very far with it. While they realize its tremendous importance in connection with the future welfare of the car department, their lack of success in solving the problem furnishes the Chief Interchange Car Inspectors' and Car Foremen's Association a splendid opportunity to make itself of real value and effectiveness to the larger association.

The same thing is true of the other subjects which are to be reported upon and it is hoped that the discussions will be freely participated in by those present. In the discussions which have been held in our columns during the past year in relation to the qualifications and training of car inspectors the fact was clearly developed a number of times that the effectiveness of the car department can be greatly increased by encouragement on the part of supervising officers of those men who occupy important, though minor, positions in the department. It is anticipated that the constitution and by-laws of the Chief Interchange Car Inspectors' and Car Foremen's Association will be amended in order to admit to its membership car inspectors, M. C. B. bill clerks and others actively engaged in the work of the car department. One way of encouraging these men would be to select a number of them who are best fitted to take advantage of it and send them to the convention. Undoubtedly the concrete returns which would be apparent within a reasonable time would many times repay the expense thus incurred.

NEW BOOKS

Oil Fuel Equipment for Locomotives. By Alfred H. Gibbings. Bound in cloth, 120 pages, 5¼ in. by 8½ in. Illustrated and indexed. Published by the D. Van Nostrand Company, 25 Park Place, New York, N. Y. Price $2.50.

This book is of a practical nature, including only such references to theory and the principles of combustion as are considered necessary in order that the subject may be clearly understood. It is intended chiefly for the use of mechanical department officers, but contains a great deal of data of use to anyone having to do with oil-burning locomotives. It deals with the different systems of burning fuel oil, the regulation of draft and of oil supply and the arrangement of the various parts of the apparatus. A chapter is devoted to tests and running conditions and one to auxiliary appliances, while there is included for reference a list of modern publications and papers on fuel oil. The illustrations are particularly clear, most of them being line engravings, although some very good half-tones are included and are of very considerable assistance in making the subject clear. There is also an inset which shows the general arrangement of the apparatus for the pressure-jet system of oil burning.

The Principles and Practice of Cost Accounting. By Frederick H. Baugh. Bound in cloth, 180 pages, 6 in. by 8½ in. Published by the author, P. O. Box 682, Baltimore, Md. Price, $3.

The author's object in the preparation of this work was to provide a comprehensive and practical presentation of the general principles upon which is based the cost accounting for manufactured articles, the application of these principles in a general manner and the illustration of the details. The objections raised by many manufacturers to the installation of a system of cost accounting have been due often to the number and complexity of the books and forms proposed and to the extra labor necessary to keep them. The author's methods call for little, if any, addition to the books which a corporation ordinarily should possess, and in this respect his work should be worthy of careful attention. The treatment of the subject is based on the assumption that the reader has an elementary knowledge of ordinary accounting and is viewed from the standpoint of the accountant rather than that of the factory manager. It does not deal with factory management, or efficiency engineering so called, except in so far as cost accounting is necessary for the purpose of efficient administration.

Power Transmission by Leather Belting. By Robert Thurston Kent, M.E., Consulting Engineer. Bound in cloth, 114 pages, 5½ in. by 8 in. Illustrated. Published by John Wiley & Sons, Inc., New York. Price, $1.25 net.

This book is one of a new Wiley engineering series, in which each book will be devoted to a single subject of engineering practice, the object being to place in the hands of the practicing engineer the essential information regarding each subject. They are intended to be more in the nature of a manual of practice than theoretical discussions of the subject treated. The work of the author in the present volume has been largely that of a compiler of the work of Taylor, Barth and others gathered from the literature of the subject, which has been widely scattered through the transactions of engineering societies and the files of technical journals. Two of the eight chapters of the book are devoted to a discussion of the theory underlying belting practice. The remainder of the book is of direct practical application to the man in the shop who has to do with the operation of the belts or to the engineer dealing with the layout of belt drives. The practical value of the book is considerably increased by the inclusion of a number of tables at the back of the book which are arranged with thumb index for convenient access. This is a feature which will be greatly appreciated by all users of the book.

COMMUNICATIONS

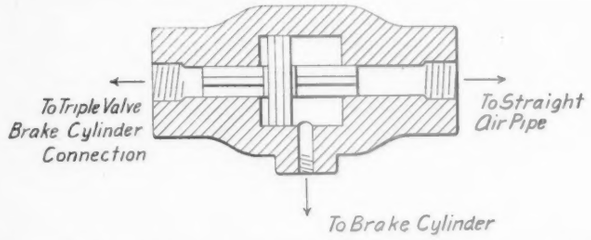
COMBINED AUTOMATIC AND STRAIGHT AIR ON FRENCH PASSENGER EQUIPMENT

Paris, France.

To the Editor:

The Paris, Lyons, Mediterranean Railway makes use of a system of combined automatic and straight air brakes on its passenger equipment which operates in a manner similar to the combined automatic and straight air brakes now in use on many American locomotives. A so-called double valve is connected up under each coach as shown in the sketch, two train pipes, of course, being necessary, one for the straight air and one for the automatic brake. The straight air is used in holding trains on long descending grades.

The operation is as follows: When the automatic brake is applied the piston moves to the right, opening communication between the triple valve and the brake cylinder. The brake is applied and released in the usual way. When the straight air is applied the piston moves to the left, thereby connecting the brake cylinder with the straight air train line, the valve remaining in this position until the next automatic application is made. In the case of a break-in-two, the automatic brake is not prevented from applying in the usual way.



Type of Three Way Valve Used in French Passenger Brake Equipment

The straight air is controlled by a wheel-operated feed valve. When screwed down tight the valve is closed, but by unscrewing it the valve is permitted to open against the tension of a spring which determines the straight air pipe pressure, the tension of the spring being decreased as the hand wheel is unscrewed.

W. G. Landon.

THE "I. C. C. DETECTOR"

Chicago, Ill.

(*With apologies to Wallace Irwin.*)

Dear Editor:

Like Hon. T. R. I have make successful come-back. Previous to position of I. C. C. detector, I have job at Lakeside shop of Western Mo. R. R. and polish tender with lampblack and oil to make brilliant for 18 hr. Royal Blue Streak.

I alight Lakeside today with new clothes and iron cross prominently display on bosom. Immediately I spy previous boss flutter around ash-pit, so I strut by with right thumb in vest corner. "Ohio," I emit for greeting. He reply with grunt, "Hello, ginney, are you still wiping tanks?" I answer with silence and blushingly flip engraved card in paw. "Ordinary hat pretty tight now, eh?" I grin with fine nature and dispense business.

I see old No. 23 approach and relate how I receive once hot water down neck when removing cinder from pit by leak in cylinder casting. On approach, I are astonish to see when steam apply same leak exist and cloud of steam flow between saddle. I announce repairs have to make and old boss reply it are impossible without renewing cylinder. I express regret with tremor in throat, but he quiet which make issue of form 5 less heartrending.

We examine five more locomotives and I are compel to form 5, four of them for following defect:

Engine No. 18 have 1 9/16 in. flange, which are dangerous on account cutting bolts on track use by flier and endanger innocent widows and orphans.

Engine No. 24 are remove from service on account cylinder valve leaking and shooting steam in right engineer window. Also it have ¼ in. lost distance between tender and 9/64 in. flat spot on couple pin.

Engine No. 26 have crack bell and won't sound by air unless assistant engineer start with rope.

Engine No. 19 do not prime water unless 3 feet in tank, which are leaking bad, headlight glass missing and can't see 1000 yards on account rusty reflector; also couple bar have hole wore oblique. Cab also need paint bad and cushions have lose most stuffing.

Engine No. 22 only one pass and she about ready for scrap, but on account old friendship, I wink at some defect and recite that it are account personal love for old boss that I relent.

I express great sorrow, but hope for 100 per cent efficiency next time while he remark in blank verse, which I unable to repeat on account censor by postmaster-general.

Yours truly,

Tobesura Weno.

THE M. C. B. BOOK OF RULES

Ludlow, Ky.

To the Editor:

I was much interested in the editorial in the *Daily Railway Age Gazette* of June 15, 1916, entitled "Suggestions Regarding M. C. B. Rules." Such a book, composed of the M. C. B. Rules of Interchange, the Loading Rules, the Tank Car Rules and the Safety Appliance Rules, which are required by the car inspector on the job, would assist him in forming quicker and better judgment regarding defects of cars, and would tend toward uniformity of judgment by all inspectors. It would give the inspectors more time, so that they could watch more carefully things that now have to be passed over hurriedly, and would reduce considerably the amount of writing which car inspectors have to do now.

M. Glenn, Sr.

Belgian Coal.—The output of coal in Belgium in 1903 was 23,871,000 tons; in 1913 the output had declined to 22,858,000 tons. The production has been practically stationary for the past 20 years. While Belgian coal mining has thus made little or no progress of late, the output of coal in the United States increased between 1903 and 1913 to the extent of 60 per cent; that of Great Britain, 23 per cent; that of Germany, 18 per cent, and that of France, 15 per cent. As the production of pig-iron from Belgian blast furnaces was increasing before the war, it was necessary to import more coal from Germany. Of course, the war has utterly disorganized Belgian metallurgy, coal mining, coal importing and other industries.—*Engineering.*

Difference in Temperature Causes Loss of Heat.—Loss of heat by radiation varies with the difference in temperature between the steam and the surrounding medium, the insulating quality or low conductivity, of the covering and the amount of the exposed area. Variations in detail in different plants vary the monetary loss by radiation, but some idea of the magnitude of this loss in one plant may be gained from the statement that by the proper insulation of a pipe having an area of 65 sq. ft., carrying steam at 150 lb. pressure, with a room temperature of 65 degs. F., the condensation has been reduced from 74.40 to 11.58 lbs. per hour. With coal at $4 per ton and with an evaporation of 11 lb. of water per pound of coal, this would be equal to a saving of about 50c. per year for each square foot of pipe.—*Power.*

LOCOMOTIVE BOILER EFFICIENCY

Not Governed by Mere Extent of Heating Surface; Firebox Offers Largest Field for Improvement

BY J. T. ANTHONY*

I

THE sustained hauling capacity of a locomotive depending primarily upon the ability of the boiler to furnish steam, it has been necessary to constantly increase the capacity of the boiler in order to keep pace with the increase in size and power of the locomotive. This has been accomplished mainly by increasing the size of the boiler, not by increasing its efficiency.

The increase in capacity of the locomotive has been accompanied by an increase in over-all efficiency. The fuel consumption per ton-mile has decreased. The steam consumption per indicated or drawbar horsepower has been greatly reduced, and so has the coal consumption; but the steam generated per pound of fuel (which is the measure of boiler efficiency) has increased only as the brick arch and similar devices have been added to the boiler. There has been little or no increase in boiler efficiency due to changes in boiler design, except in a comparatively few cases where combustion chambers have been used.

The brick arch, while by no means a new device, has come into very general use during the past five years. There are now more than 30,000 locomotives equipped with it. No change has been made in the general firebox design to accommodate the arch, although the use of the trailer truck type of engine, with its deep firebox, has greatly facilitated the arch application because of the greater firing clearance provided at the throat sheet. However, the recognized economies resulting from the arch must be ascribed to the arch, and not to any improvement in boiler design.

The wide and constantly increasing use of the fire tube superheater (more than 18,000 are now in service in this country) has effected such a marked decrease in fuel and water consumption and increase in locomotive efficiency, as to partially blind us to the defects of the locomotive boiler. There seems to be some confusion in regard to the function of the superheater, and the economies effected by it are often wrongly credited to the boiler. Primarily, it is the function of the locomotive boiler, with its self-contained furnace, to liberate the heat in the coal, absorb this heat and convert water into steam at the desired pressure. The over-all efficiency of the boiler is measured by the ratio of the heat absorbed to the heat contained in the coal as fired.

It is not the function of the superheater to evaporate water, but to increase the temperature of the steam formed in the boiler, thereby increasing its heat energy and volume per unit of weight, and making it capable of doing more work in the cylinder. The superheater absorbs a part of the heat liberated in the firebox, and this heat must be taken into account in arriving at the boiler efficiency; but the heat so absorbed increases the thermal efficiency of the engine, and does not directly increase the evaporative efficiency of the boiler.

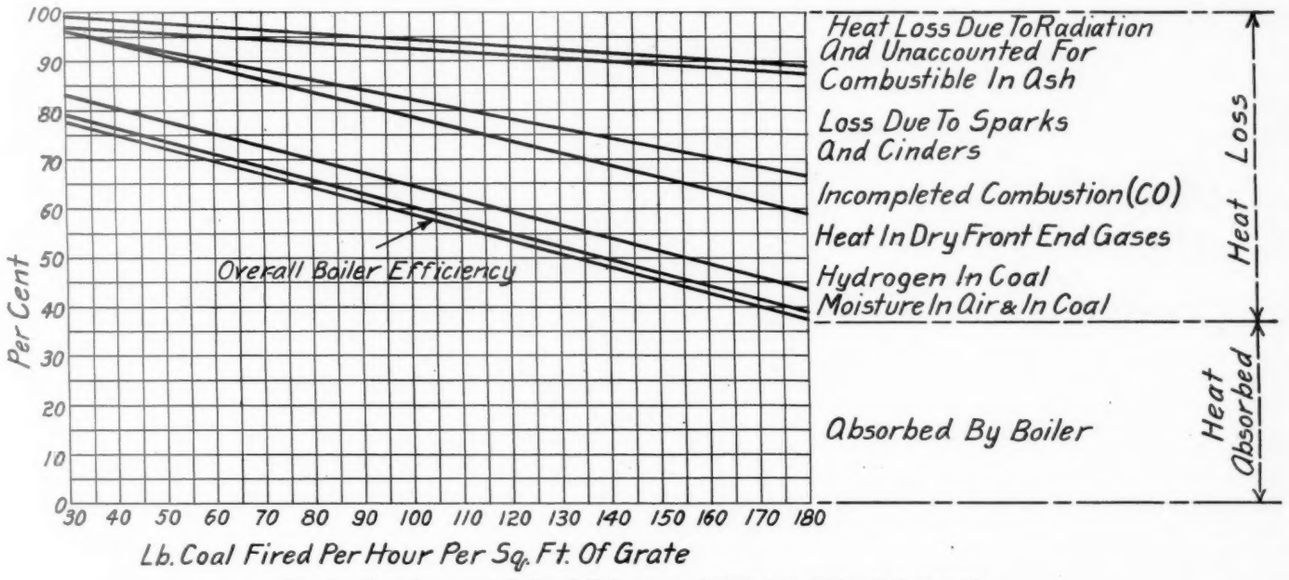


Fig. 1.—Heat Loss and Boiler Efficiency as Affected by Rate of Combustion

The addition of the brick arch has increased boiler efficiency; the addition of the superheater has resulted in a large increase in engine efficiency, and the two devices, used in conjunction with the mechanical stoker, have played a most important part in the development of the high capacity locomotive of the present; but there yet remains the difficult task of designing a locomotive boiler that will meet the combined requirements of high capacity, high efficiency, simplicity of construction and low maintenance cost—certainly a large order.

BOILER FUNCTIONS

In order to make an intelligent study of boiler efficiency and requirements, it is necessary that we consider separately the functions of the firebox, or furnace, and the heating surfaces; make an analysis of the heat losses and, if possible, determine the causes.

It is the duty of the firebox (or furnace) to liberate the

* Assistant to president, American Arch Company, 30 Church Street, New York.

heat contained in the coal; and the efficiency with which it performs this duty is measured by the ratio of heat liberated to heat contained in the coal.

The duty of the heating surface is to absorb the heat liberated in the furnace, and its efficiency is measured by the ratio of heat absorbed to heat liberated in the furnace. However, this is not the true heating surface efficiency, as a part of the heat liberated in the furnace is not available for absorption by the heating surface, and should not be charged against it; the true heating surface efficiency is the ratio of heat absorbed to heat available for absorption.

The combined efficiency of the furnace and heating surface (or the over-all efficiency of the boiler) is the ratio of heat absorbed to heat contained in the coal, although this is not the true over-all efficiency. Part of the heat loss is unavoidable, and should not be charged against the boiler.

HEAT LOSSES

The heat balance chart, Fig. 1, shows the average heat losses at varying rates of combustion on four typical boilers, such as are used on modern locomotives. While results of individual tests vary widely, as might be expected, the general trend of the heat losses is shown by the platted lines. All boilers were equipped with Security sectional arches and fire tube superheaters that were representative of present-day practice. The coal used was high volatile bituminous, containing about 35 per cent volatile matter, with a heat value of 14,000 heat units (B. t. u.) per pound, which is above the average grade of coal used in locomotive service.

A casual inspection of the chart, Fig. 1, reveals the fact that the boiler efficiency depends largely upon the amount of coal fired per square foot of grate. As the rate of combustion increases, the heat losses increase and boiler efficiency drops. The heat losses are due to:

1. Moisture in air and coal,
2. Hydrogen in coal,
3. Heat in dry front end gases,
4. Incomplete combustion,
5. Sparks and cinders,
6. Unburned coal lost through grates, and
7. Radiation from boiler and other losses unaccounted for.

MOISTURE IN AIR AND COAL

Moisture contained in the air used in burning the coal is flashed into steam in the firebox, highly superheated, and passes through the fire tubes along with the other gases, giving off part of its heat; but escaping from the stack still in the form of superheated steam, at the temperature of the front end gases. With the air entering the firebox at a temperature of 65 deg. F. and front end gases at a temperature of 600 deg. F., every pound of moisture passing out as superheated steam carries with it about 1,300 heat units. The heat loss due to this source does not normally amount to much, but under adverse conditions will reach 1½ or 2 per cent of the total heat contained in the coal.

Moisture in coal contributes to the heat losses in the same manner as moisture in air. With a coal containing only one per cent moisture, the loss under the above temperature conditions would be 13 heat units per pound of coal burned, or less than one-tenth of one per cent; but with a Western coal containing 12 to 15 per cent moisture, the loss will amount to 1½ per cent or more.

The practice of wetting down the coal on the tender is a very general one. While it contributes to the comfort of the engine crew and, under some conditions, results in a reduction of smoke and small fuel saving, the fact remains that every pound of water put into the firebox escapes at the stack as superheated steam that contains an appreciable amount of heat. The presence of a large amount of slack and dust in the coal offers the only excuse for this practice; and, with a properly designed firebox, this excuse would be largely removed.

There seems to be a prevailing idea that water in some mysterious way aids combustion—that under the influence of the high firebox temperature, it breaks down into hydrogen and oxygen; and because the former is intensely combustible and has a very high heat value, and the latter is the supporter of combustion, the result is an increase in heat generation. Needless to say, the idea is erroneous.

We have no proof that the water does break down into hydrogen and oxygen, under the influence of firebox temperatures alone. If it did, the heat absorbed by the breaking-down process would equal the heat liberated when the hydrogen was re-burned, and the net result would be, not a gain, but a loss, as the water formed in re-burning the hydrogen would escape in the form of superheated steam, as explained above.

HYDROGEN IN COAL

It is sometimes difficult for the layman to understand why the hydrogen contained in coal should contribute to the heat loss, and particularly so in view of its very high heat value. The reason, as stated before, is that hydrogen forms water when burned; and the water escaping at the stack in the form of highly superheated steam carries away and wastes the heat contained in it.

That this heat loss is high, is due to the large amount of water formed when hydrogen burns. One pound of hydrogen requires eight pounds of oxygen for complete combustion, which results in the formation of nine pounds of water. When we burn a pound of coal that contains 5 per cent hydrogen, .45 of a pound of water is formed. If this passes out the front end at a temperature of 600 deg. F., the heat loss amounts to 575 heat units, or about 4 per cent of the total heat contained in the coal. In general, the extent of this loss depends upon the percentage of hydrogen in the coal and the temperature of the front end gases.

HEAT IN DRY FRONT END GASES

The loss due to this source is almost constant, throughout the range of firing. At low rates of combustion, light fires are carried. The air supply per pound of coal is large, and the front end temperatures are relatively low. As the rate of combustion increases and the thickness of the fire increases, resistance to the passage of air through the fuel bed increases, and the amount of air supply per pound of coal decreases.

At the same time, however, the front end temperature is increased; so that in general we may say that for any one boiler this heat loss is almost constant, the increase in front end temperatures being offset by the decrease in the air supply per pound of coal burned, as the rate of combustion increases. This loss averages about 15 per cent of the total heat contained in the coal; but, as will be shown later, a large part of this loss in unavoidable, and cannot be properly charged against the boiler.

INCOMPLETE COMBUSTION—CARBON MONOXIDE

The heat losses due to incomplete combustion and the formation of carbon monoxide vary widely. On the tests under consideration, the losses averaged from zero at the lowest rate to 7½ per cent at the highest rate—although there were, in individual cases, heat losses of as much as 20 per cent due to incomplete combustion.

With uniform firing methods, the heat losses due to incomplete combustion for any one boiler will increase as the rate of combustion increases. Since this increase is always accompanied by decrease in air supply, incomplete mixing of the gases, or improper firing, this heat loss is unnecessary and can be eliminated by proper design of furnace and proper methods of firing.

LOSSES DUE TO SPARKS AND CINDERS

As shown on the chart, Fig. 1, heat losses due to sparks and cinders increase rapidly as the amount of coal fired

increases, the average losses varying from 1 per cent at low rates to 20 per cent at high rates. Individual tests will show higher losses under the same conditions, but this is a fair average. As the rate of combustion increases, the draft increases; and the increase in velocity of the air rushing through the fuel bed results in a constantly increasing percentage of the fine particles of coal being picked up and carried off unconsumed.

It is also evident that the losses due to sparks will be affected by the nature of the coal—that is, upon the amount of slack and fine particles contained in the coal—and also upon the method of firing. With an overfeed stoker, using a large amount of slack and screenings, the spark and cinder losses will be much higher than when firing with lump coal. In the former case, a large part of the fine coal is shot in above the fire and never reaches the fuel bed; but is caught by the draft and whirled into the tubes, unburned.

COMBUSTIBLE IN ASH

The heat loss due to this source is relatively small, and depends primarily upon the physical condition of the coal as to its size, and the size of the air openings provided in the grates. There is a slight decrease in this heat loss, as the rate of combustion increases—this being due to the increased draft offering more resistance to any particles of coal or ash falling through the grates into the ashpan.

RADIATION AND UNACCOUNTED FOR

Heat loss due to radiation from boiler surfaces is, under normal conditions, quite small, and should not vary with increase in rate of combustion, as the amount of heat radiated depends primarily upon the temperature of the radiating surfaces. In the case of the boiler shell this is practically constant. The temperature of the atmosphere would of course affect the heat loss; but under the most adverse conditions, radiation losses from a well-lagged boiler are of minor importance.

The radiation from the fuel bed to the ashpan is difficult to determine; but probably is not very large both on account of the interference of the grates and the inrush of cold air through the grates taking up much of the heat imparted to them.

The "unaccounted for" losses are due, in part, to the escape of unburned hydrocarbon gases (which are not revealed by the ordinary gas analysis) and in part to errors which fail to account for all of the other losses.

FURNACE EFFICIENCY

Disregarding the small loss due to radiation, we may safely assume that the losses unaccounted for, losses due to combustible in ash, to sparks and cinders, and to incomplete combustion, are all directly chargeable to the firebox, or furnace. That is, the sum of these losses represents the heat contained in the coal that is not liberated in the firebox, and is, therefore, not available for absorption or steam generation.

In Fig. 2, curve No. 1 represents the furnace efficiency. The space above this line represents the sum of the heat losses enumerated above, throughout the range of tests, being heat contained in the coal that is not liberated by the furnace. The total space below curve No. 1 represents the heat liberated by the furnace, and the ratio of heat liberated by the furnace to heat contained in the coal (as shown on the right) gives the true furnace efficiency.

At low rates of combustion (30 lb.), a furnace efficiency as high as 96 per cent is obtainable; that is, 96 per cent of all the heat contained in the coal is liberated in the firebox. As the rate of firing increases, the percentage of heat liberated decreases. At the rate of 180 lb. of coal per square foot of grate per hour, we get a furnace efficiency of less than 60 per cent; or, more than 40 per cent of the total heat contained in the coal is not liberated in the firebox, and is not available for steam generation.

UNAVAILABLE HEAT

In Fig. 2, curve No. 3 represents the over-all boiler efficiency; or, the space below this line represents the percentage of heat absorbed by the boiler at varying rates of combustion. The space below curve No. 1, under Furnace Efficiency, represents the heat liberated by the furnace at varying rates of combustion; so the difference between these two efficiency lines (or the space between curve No. 1 and curve No. 3) represents the percentages of heat liberated by the furnace and not absorbed by the boiler, at varying rates of combustion. This is the sum of the heat losses in dry front end gases, hydrogen in coal, and moisture in air and coal as shown on the chart, Fig. 1.

It is apparent that there is but a slight increase in the percentage of heat liberated and unabsorbed, as the rate of combustion increases; and that the drop in over-all boiler efficiency is due almost entirely to the inability of the furnace to burn coal efficiently, particularly at high rates of combustion.

The heat loss represented by the space between curves 1 and 3 is largely unavoidable, and can be charged only in part to inefficient heating surfaces. In order to make heat flow from one body to another, it is necessary to have a difference in temperature. When the two bodies have the same temperature, heat transfer from one to the other ceases. The same principle applies to heat transfer in the locomotive boiler. With a gage pressure of 200 lb., the temperature of steam and water in the boiler is 388 deg. F.; and it is impossible to reduce the temperature of the gas passing through the tubes below this point. If we could make the tubes infinitely long, or permit the gases to remain in them for an infinite length of time, the final temperature of the gases would be the same as that of the steam in the boiler, or 388 deg. F.

It is therefore evident that the heat required to raise the temperature of the gases from the temperature of the atmosphere to the temperature of the steam in the boiler, is unavailable for absorption and cannot rightly be charged against the boiler heating surfaces.

With an atmospheric temperature of 60 deg. and a front end temperature of 600 deg., 60 per cent of the heat contained in the dry gases is unavailable for absorption.

Similarly, the heat carried away in the superheated steam, formed by burning the hydrogen in the coal and evaporating the moisture in the air and coal, contributes to the unavoidable heat loss. A larger percentage of the heat contained in the superheated steam is unavailable, than is the case with the dry gases, due to the large amount of heat absorbed in evaporating the water into steam, the latent heat or evaporation being 970.4 heat units.

Steam escaping at the stack at a temperature of 600 deg. represents a heat loss of about 1,300 heat units per pound; but of this amount 1,200 have been consumed in evaporating the water and raising the temperature to that of the boiler, or 388 deg., leaving approximately 100 heat units (or 8 per cent of the heat contained in the front end steam) available for absorption.

The curves in Fig. 3 show the average front end temperatures, pounds of air used per pound of coal (computed from front end gas analysis) and firebox temperature, covering the tests under consideration.

Using the front end temperature shown at the various rates of combustion, and combining the unavailable heat contained in steam and dry front end gases, we find that curve No. 2 (Fig. 2) represents the amount of heat available for absorption at varying rates of combustion. The space between curves 1 and 2, then, represents the total *unavailable* heat escaping at the front end; and the space between curves 2 and

3 represents the total *available heat that is rejected* by the boiler heating surfaces and escapes at the front end.

HEATING SURFACE EFFICIENCY

The true heating surface efficiency is the ratio of heat absorbed by the boiler (represented by the space below curve No. 3) to heat available for absorption (represented by the space below curve No. 2). These ratios are platted at the various rates of combustion and shown at the top of the chart by the dotted line. This indicates that the locomotive boiler heating surfaces absorb from 96 to 84 per cent of the *available* heat.

A comparison of the curves representing the true heating surface efficiency and furnace efficiency is enough to warrant the broad statement that the inefficiency of our modern locomotive boiler is due largely to the inability of the present design of firebox to liberate the heat or properly burn the coal that is fired.

HEAT DISTRIBUTION

The small diagrams (*A*, *B*, *C*, etc., Fig. 2) will perhaps show more clearly the distribution of heat and heat losses referred to heretofore. The height of a rectangle represents the 100 per cent of heat contained in the coal; and the base represents the pounds of coal fired per hour per square foot of grate, as shown in the large chart of Fig. 2. The total heat in the coal fired throughout the range of tests being represented by the area of the rectangle, the shaded portion of *A* represents that portion of the heat liberated by the furnace, as the rate of combustion increases from 30 to 180 lb. The shaded portion of *B* indicates the amount of heat absorbed by the boiler under the same conditions. The shaded portion of *C* represents the amount of heat lost by the furnace; or, more correctly, the amount of heat contained in the coal that is not liberated by the furnace, but is chargeable to the furnace. The shaded portion of *D* represents that portion of the heat that is *rejected* by the boiler heating surfaces and is chargeable to them. The shaded portion of *E* represents the heat that is *unavailable* for absorption, and that cannot be properly charged against the boiler heating surface in considering its efficiency.

FURNACE LOSSES

Diagrams *C* and *D* show heat losses that are directly chargeable to the design of the locomotive firebox and boiler. Both of these losses are preventable in large part, but it is very evident that the furnace (or firebox) presents a much wider field for improvement in design and efficiency than do the boiler heating surfaces.

The principal furnace losses are those due to sparks and cinders; incomplete combustion, allowing the formation of carbon monoxide, and the escape of unburned hydrocarbon gases. Of these, the loss due to sparks and cinders is the most serious.

As shown in Fig. 1, these losses increase rapidly as the rate of firing increases. In order to burn more coal on any one grate, it is necessary to increase the draft. This increase in draft—or drop in pressure—results in an increase in the velocity of flow of air through the fuel bed, and the flow of gases into the tubes.

In order to approximate complete combustion in a locomotive firebox at moderate or low rates of firing, it is necessary to have an air supply of 15 or 16 lb. per pound of coal. At atmospheric temperature, this means that we must furnish approximately 200 cu. ft. of air for every pound of coal burned. At the low rate of 60 lb. of coal per square foot of grate per hour, a locomotive with 70 sq. ft. of grate area will require 14,000 cu. ft. of air per minute. With an air opening through the grates of 30 per cent—which is higher than the average practice today—the velocity of the air going through the grates would be about 700 ft. per minute, or over 11 ft. per second.

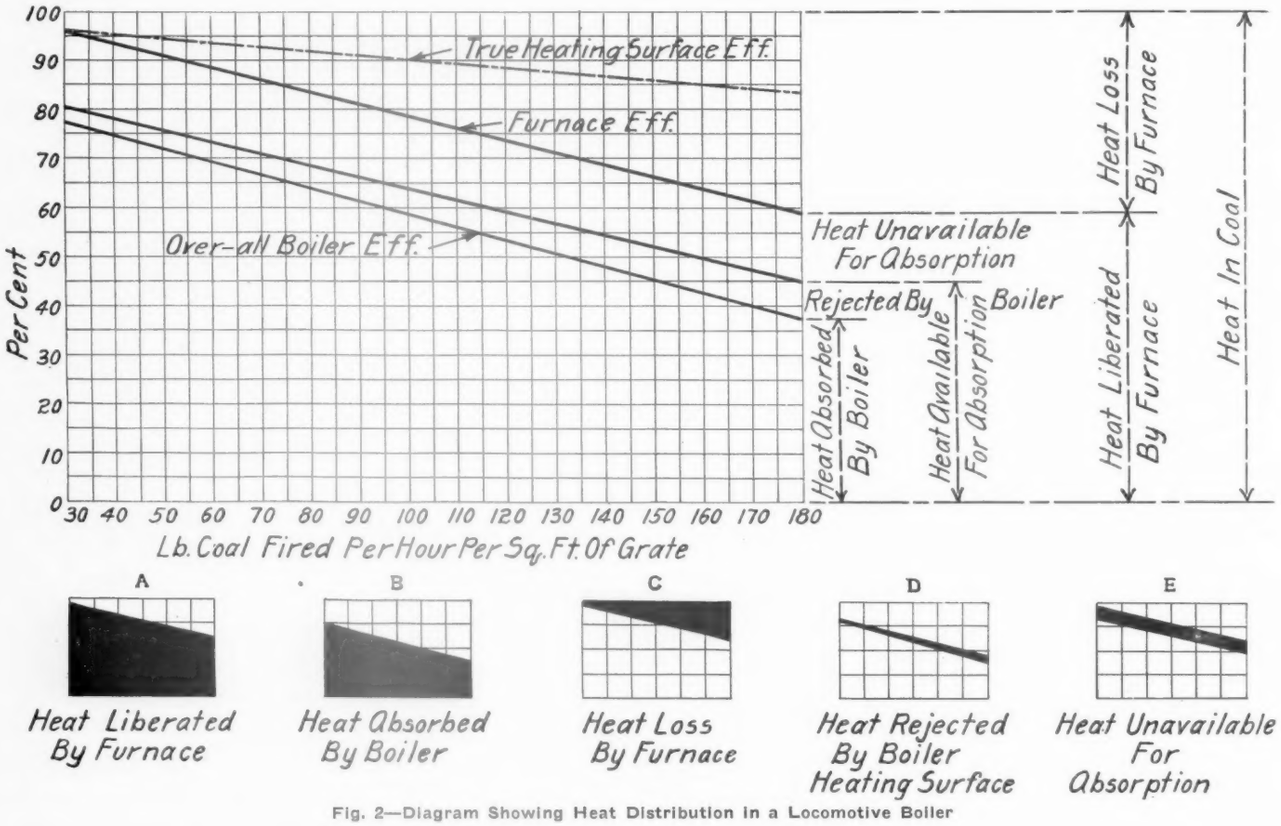


Fig. 2—Diagram Showing Heat Distribution in a Locomotive Boiler

The total air openings through the fuel bed will of course depend on the nature of the coal and the thickness of the fuel bed, principally the latter, as experiments show that the resistance to the flow of air through the fuel bed varies directly as the thickness of the fuel bed. While it is impossible to even approximate the amount of air opening through a fuel bed of any thickness, it is safe to assume that this is a good deal less than the air opening through the grates, and the gases will pass through and leave the fuel bed at a much higher velocity than that at which the air leaves the grates.

Assuming the gases to leave the fuel bed at a temperature of 2,200 deg., the volume would be increased to approximately 75,000 cu. ft. of gas per minute, and the velocity would probably approach 7,500 ft. per minute, or 125 ft. per second, which is equivalent to 85 miles per hour. It is not difficult to imagine the action of such a hurricane on the fine particles of coal; though, under the conditions named, the loss due to cinders would amount only to about 5 per cent. As the rate of combustion increases, the velocity of the gases leaving the fuel bed and entering the tubes also increases. These velocities range, in ordinary locomotive practice, from 100 to 300 ft. per second, or as high as 200 miles per hour.

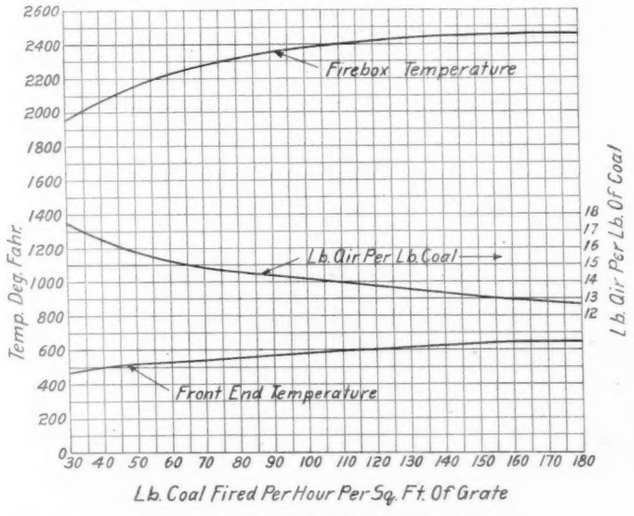


Fig. 3—Air Supply and Temperatures

It might appear that with such velocities it would be impossible to hold the fine particles of coal in the firebox long enough to burn them; but the successful application of pulverized coal-burning apparatus to locomotive type boilers and the approximately perfect combustion obtained prove conclusively that fine coal can be burned completely in a locomotive firebox. The fineness of the coal and the method of firing are important factors in burning pulverized coal, but the same general principles are applicable to the burning of lump coal containing a large amount of slack.

In order to do this successfully, it is necessary to make the following provisions:

1.—Large grate area, in order that a light, level fire may be carried, thereby insuring an ample and uniform flow of air through all parts of the fuel bed.

2.—Refractory baffles and mixing devices that will tend to hold the fine particles down until they are ignited, and to thoroughly mix those particles carried in suspension with the oxygen present.

3.—Combustion chambers of ample volume and length, thereby reducing the velocity of flow of the gases, and giving the solid particles of coal carried in suspension more time to burn.

The furnace losses due to incomplete combustion, or the formation of carbon monoxide—and in many cases the escape of hydrocarbon gases totally unburned—can be eliminated or greatly reduced by the provisions mentioned above.

These losses are due principally, if not entirely, to the lack of sufficient air or oxygen; to imperfect mixing of combustible gases with the oxygen that may be available, and to the lack of sufficient combustion chamber space. A large portion of bituminous coal burns as a gas, and in order to burn it successfully, it is necessary to make the above provisions.

It is impossible to lay down any fixed rules governing these requirements. The amount of excess air needed to complete combustion will depend upon the efficiency of the mixing devices, upon the length and volume of the combustion chamber and upon the amount of volatile combustible in the coal and the amount of coal being burned. The length and volume of the combustion chamber will in turn depend upon the amount of volatile to be burned, the amount of oxygen available for combustion and the efficiency of the gas-mixing devices.

Front end gas analyses usually show a surplus of oxygen in the presence of carbon monoxide, thereby indicating that the incomplete combustion is not due to lack of oxygen, but to inefficient mixing of the combustible gases with the oxygen present. As the thoroughness of the mixing increases, the excess supply of oxygen can be decreased, other factors remaining the same. The length and volume of combustion chamber space also plays an important part in promoting complete combustion. Any increase in combustion chamber space means additional time for the mixing and burning of the volatile combustibles; but the effectiveness of the combustion chamber can be best promoted by increasing the length rather than the cross sectional area.

When burning 60 lb. of coal per square foot of grate per hour in a firebox with 70 sq. ft. of grate and a volume of 300 cu. ft., the products of combustion arising from the fuel bed have a volume sufficient to fill the firebox completely, four times per second. This means that the average time available for the burning of each particle of gas or coal-dust is only one-fourth of a second. Combustion is a series of explosions, and progresses with almost incredible velocity, hence this one-fourth of a second might be ample, if the temperatures were sufficiently high to insure instant ignition, and the air supply sufficient to insure every particle of combustible coming into immediate contact with the requisite amount of oxygen.

However, in order to insure this last, it is necessary to have an excess of oxygen present. As the rate of firing increases, the amount of volatile combustible and coal-dust also increases, almost in direct proportion; while the air supply per pound of coal decreases, owing to the increase in thickness of the fuel bed and the resistance it offers. At the same time there is an increase in the temperature of the firebox, which gives an increase to the volume of gases, in addition to that due to the burning of more coal.

By increasing the rate of firing from 60 to 120 lb. of coal per square foot of grate per hour, we practically double the volume of the gases discharged from the firebox, or we cut the time available for combustion in half. In other words, the gases fill the firebox eight times per second; and the time available for combustion is one-eighth of a second, while the supply of oxygen is reduced by the decrease in air supply. Under these conditions, in order to insure approximately perfect combustion, the mixing of the gases would have to be more effective than in the former case; and combustion chamber space would have to be increased proportionately.

It was stated that combustion is a series of explosions that takes place with great velocity. This is true when combustion begins; but as it proceeds it becomes slower and slower. This is due to the presence of the inert gas, nitrogen, and to the ever-increasing mass of the burned gases. This increase in the mass of the burned and inert gases in propor-

tion to the combustible gases present, tends to separate and interfere with the mixing of the combustible with the decreasing supply of oxygen, and makes their union more difficult and retards theeir burning.

Tests made with brick-lined combustion chambers of extremely long lengths have shown that combustion takes place at a distance of more than 30 ft. from the bridge wall separating the grates from the combustion chamber; and indicates the effect of limited firebox and combustion chamber volume on fuel economy in locomotive practice. Heat losses due to high rates of firing and the attending reduction in air supply can be greatly reduced by the use of liberal combustion chambers; but this fact seemingly has not been appreciated.

(To be continued.)

GARRATT TYPE LOCOMOTIVES FOR BRAZIL

The illustration shows a Garratt type locomotive which was recently built by Beyer, Peacock & Co., Ltd., Manchester, England, for service on the San Paulo Railway of Brazil.

This type of locomotive consists of three units: the two motor trucks and the boiler, on a rigid main frame. The location of the boiler on the frame is such and the frame is so connected to the trucks that an equal distribution of weight is effected on all driving wheels. The fuel and water are carried directly on the truck frames and as they decrease in amount the distribution of weight is not affected sufficiently to have any appreciable effect upon the running of the engine.

The operation of the engine on curves is similar to that of a car with trucks at either end. The center line of the boiler and frame forms a true chord to the curve over which the locomotive is running, the sharper the curve the more the inside overhang of the boiler. The center of gravity of the boiler is thus brought inside the center line of the track and a greater resistance to the centrifugal overturning action is thereby effected. This is said to be borne out in practice, the steadiness of engines of this type on curves at high speeds being very noticeable. The outer rail on curves is also relieved of part of the centrifugal pressure which it must resist with other types of locomotives, and the remaining pressure is divided into two parts acting at considerable distances from each other. This fact is reflected in the life of tires which is said to be considerably longer than with other types of locomotives.

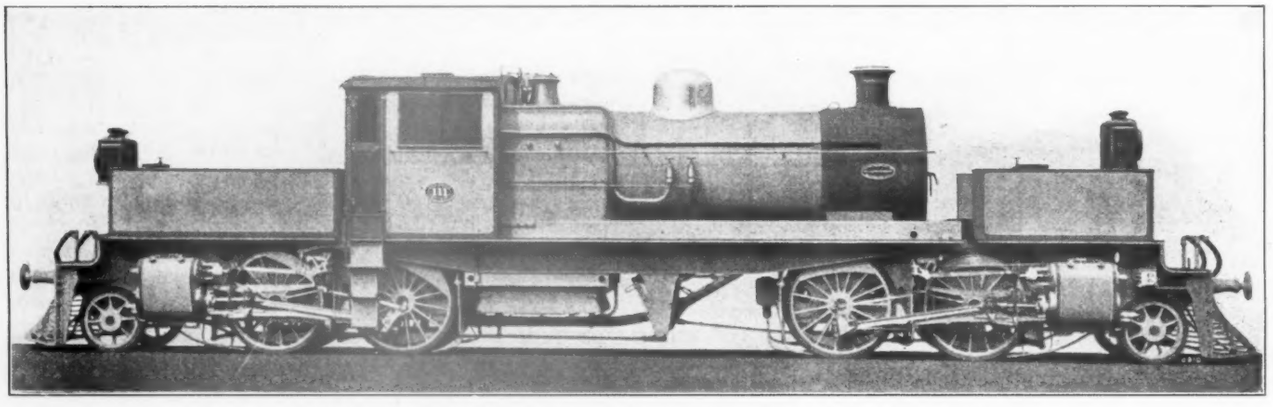
The freedom from restrictions imposed by the running gear in the design of the boiler is evident. The boiler may be kept lower and still permit the design of a firebox of any dimensions desired without interference from the wheels.

The steam pipe arrangement is simple, the flexibility being obtained by a ball joint on the center line of the truck. The movement here being very small, little wear takes place. Originally, locomotives of this type were designed with a single exhaust pipe through which the exhaust from the motor truck cylinders was discharged. Owing to the fact, however, that the exhaust from the two trucks has not always remained in synchronism, the beats become irregular and vary in intensity, thus giving an irregular draft on the fire. When the engine is working very hard, there is also a tendency for the exhaust to create a detrimental back pressure unless the opening is so large as to be unsatisfactory under medium or light loads. These engines are now provided with separate exits for the two units, one being concentric with the other and the areas being made equal to each other.

The San Paulo locomotives are designed for a 5-ft. 3-in. gage and have driving wheels 60 in. in diameter. Each engine unit has a wheel base of 13 ft. 10 in., the rigid wheel base being but 6 ft. The ability to negotiate sharp curves is therefore apparent.

The cylinders are four in number and are all simple, the diameter being 16 in. and the stroke 24 in. The locomotive is fitted with a superheater, and the steam is distributed to the cylinders by the Walschaert valve gear.

The engine has no tender and may therefore be operated equally well in either direction. The total water capacity of the tanks is 1,500 gal., of which 850 gal. is accommodated in the smokebox end and 650 gal. in the firebox end. A fuel space for 2½ tons of coal is provided at the latter end.



British-Built Garratt Type Locomotive for the San Paulo Railway, Brazil

Some of the principal dimensions of the San Paulo locomotives are as follows:

General Data

Gage	5 ft. 3 in.
Fuel	Coal
Tractive effort	27,850 lb.
Wheel base, rigid	6 ft.
Wheel base, unit	13 ft. 10 in.
Wheel base, total	47 ft. 10 in.

Cylinders

Kind	Simple
Diameter and stroke	16 in. by 24 in.

Valves

Kind	Piston
Valve gear	Walschaert

Wheels

Driving, diameter over tires	60 in.
Engine truck wheels, diameter	36 in.
Trailing truck wheels, diameter	36 in.

Boiler

Style	Belpaire
Working pressure	160 lb. per sq. in.
Outside diameter of first ring	64⅞ in.
Firebox, length and width	67 13/16 in. by 63½ in.
Tubes, number and diameter	183—2¼ in.
Flues, number and diameter	24—5¼ in.
Tubes and flues, length	10 ft. 4½ in.
Heating surface, tubes and flues	1,396 sq. ft.
Heating surface, firebox	145 sq. ft.
Heating surface, total	1,541 sq. ft.

Superheater heating surface	304 sq. ft.
Equivalent heating surface*	1,997 sq. ft.
Grate area	30 sq. ft.

Tank

Water capacity	1,500 gal.
Coal capacity	2½ tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

PREPAREDNESS—THE HUMAN ELEMENT

BY JOHN H. LINN

Nowhere is there greater need for preparedness than in the mechanical department of our railroads. Long ago the railroads realized the need for preparedness in locomotives and cars and in shop plants and shop machinery and the material which enters into their construction. Have they made sufficient effort to prepare and train the men who are to man the shops, set up and operate the machines, and to do the thousand and one jobs incident to the building and repairing of locomotives and cars?

Whether the government, if the proposed plans for national preparedness are adopted, builds additional arsenals and ammunition plants of its own, or arranges to use the shops already manned and equipped by the manufacturing concerns or railroads, many of the mechanics who do this work will necessarily be recruited from those now working on locomotives and cars. Where are the additional men to come from? Those railroads which have adopted modern advanced systems of apprenticeship are indeed fortunate for they have practically solved the question so far as mechanics for the ranks are concerned. This is a big step in advance and the other roads might well profit by the results these pioneers are achieving, but we must not be content in preparing men for the ranks. This article is intended not so much to discuss the selection and preparation of men for the ranks but of men who are to lead and guide the rank and file and the countless other men who are needed to fill the numerous special jobs which arise in the mechanical department.

It has been said that if we take care of the men in the ranks the leaders will take care of themselves. This sounds all right, but will not work out to a satisfactory solution. It is possible in our army and navy for a Fred Funston to work up from among the volunteers, but were all our best leaders obtained in this way we would not have our splendid schools at West Point and Annapolis; neither would such care be taken in the selection of men who are to be trained in these schools. Neither can we trust to the survival of the fittest with no thought of the conservation or development of the many others capable of making good under right conditions. In the struggle for survival a Lord Kitchener may be lost while the deckhand survives. Neither can we afford to trust the selection and promotion of these men to chance or favoritism.

Too many capable men are shut in blind alleys. Too many good men are held in their present places by selfish foremen, who think only of immediate gain or their own personal advancement. Are not the interests of the company best taken care of by taking care of each man's best interests? Surely a man should not be denied promotion because of making good where he is.

If we are to secure the best men and get the most out of them we must be sure that each man selected is intrinsically worthy and that his qualifications particularly fit him for the job in question, and that the experience which he has already received and which he may still receive is such as to guarantee his making good. The man may be a good man, capable of success elsewhere, and yet fitted neither by nature nor training for the job in question. Too much care cannot be taken in fitting the man for the job.

When the sower went out to sow, the seed which fell upon the stony ground was perhaps just as good seed as that which fell upon good soil. The modern, scientific farmer knows that if he is to raise a good crop he must be careful in the selection of the seed with which he starts. He must know that it is not only a good variety, but that it possesses sufficient vitality to insure its germination, and he must also consider the soil and the season. One field will raise good alfalfa while another had better be planted in corn, or wheat, or cotton, or rice.

And so it is in the mechanical world. Every manufacturer knows that if he is to compete in the open market, if he is to hold his present trade and hope to secure new customers, he must be very careful in the selection of the raw material from which he makes his product, and so we have our trained, experienced inspectors and expensive testing plants, every bit of material being carefully selected not only in reference to its intrinsic value but with particular reference to the specifications approved for that particular job.

Each of the young men in our shops is a wonderful bit of mechanism. His body, mind, and spirit constitute a wonderfully complex and intricate whole. This mechanism is easily put out of balance and destroys even itself if an effort is made to operate it off the track on which it was meant to go. Just as the locomotive when off the track dashes over the precipice, butts into the cliff, or falls into the river, or topples over when it attempts to round a curve to which it has not been adjusted, so with these human mechanisms. But if once on the right track even though the grades may tax his strength or challenge all his powers, still if he and those who guide him skillfully and intelligently manipulate the levers and valves and brakes there is no limit to what he may accomplish. Is it not certain that in our shops today are many an Edison, Westinghouse, or Baldwin?

Much has been said about fitting square pegs in round holes, and round pegs in square holes. If it is important to be so careful in the selection of material in the inanimate world, how much more need is there for care in the selection and training of the human element?

How are these men to be selected? Certainly only haphazard results will be obtained if they are selected by any haphazard method. Is not the question of sufficient importance to justify an organization with some central head to recommend men for promotion? Is not the power in these human engines as worthy of conservation and development as that in our power houses?

Where there is a central apprentice organization this department is in a position to handle the matter, for it should already have knowledge and record of its apprentices and apprentice graduates. The older men should not be forgotten, but naturally the best results will come from the young men, particularly those who have served their apprenticeship. The apprentice instructor should get so close to these fellows as to know their every ability, their every ambition. Unless he does this he is not in a position to say what each can do or what he cannot do. As he learns of certain qualifications which may fit him for special work or for leadership, he should pass this knowledge on to the master mechanic and to the supervisor of apprentices, or whoever has charge of maintaining the record and recommending men for promotion. The latter should not only keep thoroughly in touch with all these boys and men, but should keep a list of available material for each job for which men are likely to be needed, and when a vacancy occurs should carefully investigate the merits of all such available material so as to be able to recommend the man who gives most promise of making good.

What qualifications should be considered paramount? The answer depends upon the nature of the job to be filled. Some of the general qualifications, however, which should be considered are the man's ability as a mechanic, the experience which he has received, his education and training, his parentage and home environment, his habits and morals, his

physique and health, his personal appearance and personality, his industry and ambition, his self-confidence and assertiveness, his discretion and tact, his ability to mix, his "pep" and "sticktoitiveness," his action under fire, his ability to lead and to guide, his loyalty and love for his work and for the company by whom he is employed.

When the man has been promoted he should still be looked after and guided. A certain amount of responsibility and heavy grind may be necessary to temper the metal which is in him. But he should not be left to sink or swim with no rescuing hand near. Many a man has been lost when beyond his depth, who, had he remained a little longer in shallow water, especially with proper training, could have readily learned to swim the tide. One good act or deed well performed does not constitute success. Neither does one mistake constitute failure. A child falls down many times when learning to walk. Yet every one must learn to walk before he can run. Let us be firm, yet patient with these men. Materials destroyed may be replaced and their value determined, but who can replace a life destroyed or estimate the possibilities which it might have achieved if well directed?

A QUESTION OF PROMOTION

BY GULF

I wonder if Thompson inspired that editorial on "Are You Guilty?" in the last issue of the June *Daily*.* It sounds like an echo of his experience, because you know echoes are always reversed.

No, Thompson wasn't promoted, and I don't think he regrets it. You see it was this way:

Thompson was a hustler—the real article, with a lot of ambition mixed up with his hustling. He was thorough, too. When he left college his first move was to learn the machinist's trade and perfect his drawing and then when an opening came in the master mechanic's office of the A. B. C. Ry. he jumped into the place and proceeded to make good.

He didn't know much about locomotives, but he had a head on his shoulders and wasn't afraid of work. In fact, didn't know what it was. He declares now that he never did a day's work in his life. It has been one long, joyous holiday of play. He had the enthusiasm of youth, with the love of machinery that the artist has for the beautiful. He spent eight hours a day at the drawing board and six outside, studying to solve the problems that rose ahead of him, and the "Old Man" soon got to trust him because he made no mistakes. He was working for love of doing and in hope of appreciation.

The A. B. C. wasn't very progressive. It used Eight-wheelers when its neighbors had gone to Consolidations, and it standardized its valve motion, by using the same gear on switchers that it did on its fast passenger engines, because it had a template for the link. There were a lot of little things like that that Thompson, as he learned things, was itching to correct. He was so much of a machinist that the men in the shop respected him and came to him for pointers on methods of doing work. Oh, he was making good, all right!

But there was a consolidation and the "Old Man" went to a new office, where he had a real drawing room, clean and airy, not a drawing table by a window looking out on a roundhouse roof where Thompson was ecstatically learning locomotives.

Of course, Thompson expected to go with the "Old Man." But he didn't, nor did his chief clerk, nor did any one else. The new chief draftsman (mind you, Thompson had been simply "draftsman," the one and only) was brought in from outside.

Thompson was no fool and no egotist. He sized up the Interloper at short notice and saw that he was the better man of the two. Broader experience, and all that; still he would have liked mightily to have had the chance to show what he could do. He didn't complain and was frank enough to say that the "Old Man" had gotten a better man when his fellow employees said that he ought to have had the job. But he kept his eyes opened, and proceeded to find out what the other fellow knew.

Well, it was the old story. A man who loves his work and so does it well soon has opportunity knocking at the door, and it was not long before the knocker on Thompson's door was thumping. Opportunity offered him an industrial position at higher pay. But Thompson loved a railroad and a locomotive, and went to the "Old Man" and laid his case before him.

"I don't want to leave, I like it here. The salary doesn't influence me. But what are my chances for promotion?"

"Well," said the 'Old Man,' "promotion comes pretty slowly on this railroad. I don't want to lose you, but I guess you'd better go."

And Thompson went, and took his hustling enthusiasm with him. Of course, it counted as an asset in his career, and he proceeded to climb. In a few years he was superintendent of a large manufacturing concern, but never lost his old love for the locomotive and always called at the old office of the A. B. C. headquarters when he was in town. As years passed, he always found the Interloper at the same drawing table; his old office mates were always at their old book, and it was only in the upper office that he found new faces. Why? Well, he was always told that they were too valuable where they were to promote. He asked as to salaries and found that the Interloper, whom he had once envied, has been raised ten dollars a month in 10 years—because he was too valuable to promote.

But Thompson still grew and, being an outsider, even the A. B. C. regarded him with respect and he was sometimes called into their councils. Then he found that they were all outsiders. They had grown up under different systems, with different ideals. Each felt a little jealous of his neighbor. Each fought for departmental rights and the A. B. C. paid the bill.

And Thompson, as he grew and was consulted by all of the roads from the A. B. C. to the X. Y. Z., found many interesting things. Where the officers were outsiders, he found jealousy, suspicion, selfishness and all uncharitableness. But where the president had been an office boy at his own door, where the chief engineer had been a rodman and the superintendent of motive power had been an apprentice, and all had grown up in the service, he found a harmony of action and a teamwork that would have done credit to any ball-playing organization on earth. It was the railroad first, last, and all the time, and departmental jealousies were hidden in the darkest of closets.

Thompson often wonders what would have happened to him if the Interloper hadn't come in. Possibly he might have stagnated in his surroundings; probably not. The A. B. C. did not go broke because it lost Thompson, but it did lose a very loyal and efficient servant, just the same, when it didn't give him that draftsman's job. I wonder what the increase in the number of Thompsons in the railway service would be, if more officials could plead, "Not Guilty."

* Daily Railway Age Gazette, June 22, 1916, page 1508.

UNITED STATES STEEL TRADE.—The United States has furnished nearly 80 per cent of Great Britain's imports of semi-finished steel since the war started, whereas previous to the war the United States furnished less than 20 per cent of such imports, and Germany nearly 80 per cent of the total. In the first two months of this year the United States furnished 84 per cent of the British imports of semi-finished steel.—*Iron Age.*

Car Department

THE CAR INSPECTOR AND HIS JOB

The following extracts are taken from contributions which were made to the car inspectors' competition, which was held the latter part of 1915:

BY MICHAEL GLENN
Car Inspector, Cincinnati, New Orleans & Texas Pacific, Ludlow, Ky.

A car inspector must be bright, intelligent, sober, and know how to obey orders. He should first work on the shop repair track for about two years in order to know all the parts of a car, how to repair a car, to realize when wrong repairs have been made, to know how to test air brakes, and to understand the safety appliances requirements. He should then serve for one year as an oiler and obtain a thorough understanding as to how to oil and pack the boxes and know when a journal needs to be rebrassed. For the next year he should serve with the chief interchange inspector in order to learn how to recognize defects and just how they should be handled. He must, of course, know the M. C. B. rules of interchange and should understand when to issue M. C. B. defect cards and how to handle correspondence in the office of the chief interchange inspector.

After this preliminary training he can be given a position as car inspector, but for some considerable time should work in conjunction with a good car inspector of extensive experience. In addition to the routine work he should do his part in preventing claims caused by defective equipment; should do everything consistent and within his power to please the shippers, and work in harmony with the yardmaster. Obviously the car inspector should have a common school education; in addition to this he should attend night school for at least a couple of years.

BY JOSEPH DALZELL
Car Inspector, Pennsylvania Railroad, Pitcairn, Pa.

When a car repairman shows special ability in his work, knows all the parts of a car and how it is constructed, and can make light running repairs to brakes, draft gear, etc., he should accompany a car inspector and note the defects that condemn cars and send them to the repair shop; or he may be placed on a shop repair track in order to become familiar with shop practices. It is at this time that he should familiarize himself with the M. C. B. rules of interchange and be given practical instructions in repairing and inspecting air brakes. He must also prepare to pass the required examination for inspectors on the air brake and train air signal instructions.

Meanwhile, as he develops step by step, he should have an opportunity of becoming familiar with such things as ventilation, refrigeration and seal records. He must also understand the rules governing the loading of long material and should hold for orders those cars that exceed the clearance dimensions of his road. Then, too, he must be given special instructions concerning the application of safety appliances and the rules relating to the transportation of explosives and dangerous articles other than explosives.

He must understand many things in the railroad's book of rules so that he will know when an order or rule has been violated He should also familiarize himself with the general track conditions and their relation to car derailments and should be trained to furnish accident reports to his superiors.

BY W. S. CLARK
Foreman Car Department, New York Central, East Syracuse, N. Y.

Wherever possible, an employee who is finally elevated to the position of car inspector should first be assigned to repairing freight cars on a branch line in order to become thoroughly familiar with car instruction and have a clear understanding of the federal requirements concerning safety appliances. In most cases, however, it will not be possible for him to secure his experience in this way and he should be employed first as an oiler. Obviously one of the most important things to be done at the very outset is to instruct him in the principles of safety first and have him read and acknowledge receipt of instructions relating to the protection of inspectors and others working under or about cars. The oiler should be furnished with a copy of the instructions governing the care and lubrication of journal boxes and should be compelled to study them. The foreman in charge can check this by questioning the oiler from time to time and having him demonstrate that he understands the details of this work; in case he should not thoroughly understand any of the rules, his superiors should explain by practical demonstration.

When the oiler has proved competent in his work he should be promoted at the first opportunity to the position of a running repairman and should be instructed by the chief inspector as to how properly to make repairs marked up for him. The repairman's work should be checked closely and in case of mistakes he should have his attention called to them and be instructed as to how to make the repairs properly.

The next step upward should be to the position of car inspector. He should be provided with copies of the various rules and regulations which govern the handling of his work and should be accompanied by the chief inspector when he makes his first inspections. Moreover, the chief inspector should make it a point to quizz him on questions pertaining to the inspection and safe movement of cars and should promptly correct him on any point that he does not understand.

The chief inspector should hold meetings at least once each month for the instruction of inspectors, running repairmen, air brake men and oilers, and new inspectors especially should be compelled to attend these meetings. Among other things, the inspector should be impressed with the seriousness of a possible accident caused by his carelessness in inspection. He should be disciplined by suspension or dismissal if he persists in ignoring instructions or becomes careless in the performance of his duties. After being thoroughly trained he should be compelled to take a written examination every two or three months. His examination papers should be carefully checked, the percentage recorded and any errors brought to his attention in order that he may benefit thereby.

About 8,500 cars are handled through our DeWitt yard every 24 hours. These include 40 symbol trains in addition to the slow freights. There are six different inspection

points. The inspectors in the slow freight yards are instructed and trained just as thoroughly as those in the fast freight yards. This thorough training has caused practically the tying up of our wrecking outfits, as the inspectors do not allow any cars to leave the yards that will not stand up in present-day heavy trains.

The inspectors are trained to consult the train crews upon arrival in the yard to ascertain whether they have had any trouble on the road; this makes it possible to remedy any unsafe condition that might otherwise be overlooked. The inspectors are also instructed to report any defects on new equipment with a view to having such defects remedied as additional new cars are turned out at the car builder's plant.

SPECIAL TOOLS FOR THE CAR DEPARTMENT*

Inspection Mirror.—Considerable difficulty has been experienced in locating the defects in arch bars of freight cars and tender trucks, especially when the cracks occur on the inside of the bar. It is practically impossible to locate the defect by the ordinary methods of inspection. A very simple expedient has been tried and found to be remarkably

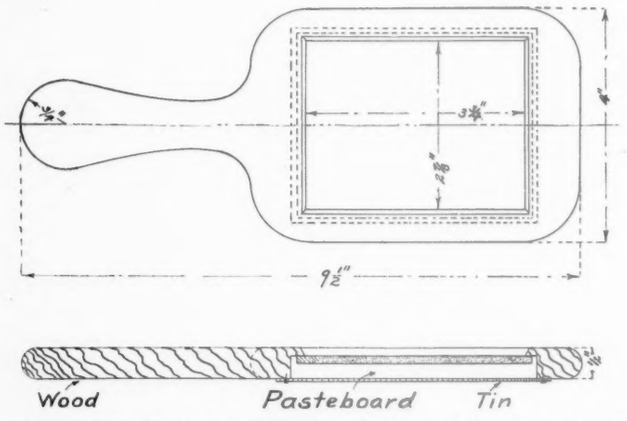


Fig. 1—Hand Mirror for Inspecting the Inner Side of Arch Bars

successful in aiding the inspector to locate these defects. The inspector is provided with a small hand mirror, such as is shown in Fig. 1. By holding it on the inside of the bar any crack or other defect can be readily discovered. The results obtained are astonishing. On one road in five months'

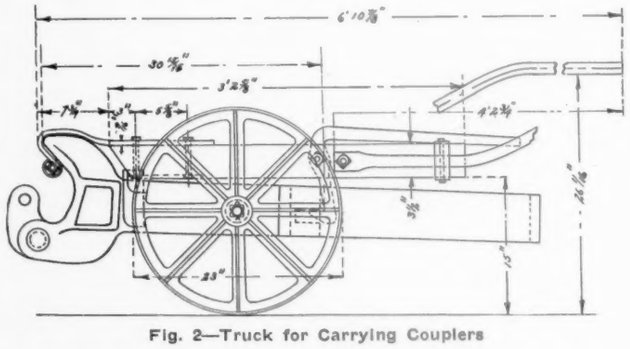


Fig. 2—Truck for Carrying Couplers

time, 1,488 failures were discovered which by the ordinary method of inspection would have been missed. Thirty-four broken bars were discovered in this way in two months at one terminal, forty-two at another in one month and seventy-six at another in ten days.

*From a paper on Car Department Problems presented by E. E. Griest, master mechanic, Pennsylvania Lines, Ft. Wayne, Ind., at the General Foremen's Convention.

Wagon for Hauling Couplers.—It is necessary in every car department to transport considerable material from point to point in the repair yard. Any simple device which reduces the time and labor in handling material is worthy of consideration. In Fig. 4 is shown a truck designed for readily handling couplers. The wagon is tilted forward until the rear hook engages the cored hole at the end of the coupler shank. When the truck is again brought to a horizontal position, the coupler swings high enough off the ground to clear objects 6 in. high. With this arrangement couplers can be readily loaded, transported and unloaded by one man.

Reclaiming Car Brasses.—The common method of re-

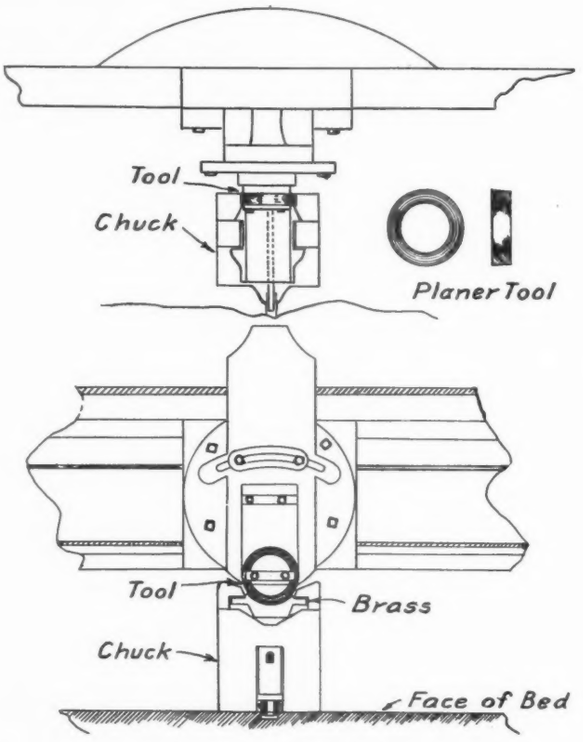


Fig. 3—Broaching Tool for Reclaiming Car Brasses

claiming freight car brasses when scored and unfit for further use is to remove the babbitt and renew it. In a large number of cases, the scored babbitt is still thick enough to be well outside the limits prescribed by the specifications. A saving could be effected if they could be cheaply rebored. In Fig. 5 is shown a method of performing this work on a planer by the use of a special planer jig and tool. The jig is fastened to the planer bed and clamps the brass by means of two fingers actuated by a wedge. The tool is merely a tapered ring with the large end of the same diameter as the standard journal, faced off flat to furnish a cutting edge. It is rigidly held in the tool head with the usual clamps. It may be revolved from time to time as the cutting edge becomes worn. It is estimated that through the use of this tool, a saving of over $300 annually is effected at one shop where it is used. The price paid for reboring the brasses is $.01 each.

Crankshaft Endplay.—Endplay of a crankshaft may be caused by the crankpin brasses being out of line and bearing alternately on opposite ends of the crankpin, or by the shaft being out of line, causing a wobbling motion of the flywheel, or, in a single-crank engine, by lost motion in the crankshaft bearing.—*Power.*

PROBLEMS OF THE CAR DEPARTMENT

A Paper Presented at the Recent Convention of the General Foremen's Association, Held in Chicago

BY E. E. GRIEST

Master Mechanic, Pennsylvania Lines West, Fort Wayne, Ind.

IT is the tendency on most roads to rely on the car foreman entirely for all matters connected in any way with the car department, the general foreman confining his activities entirely to the locomotive department; consequently, when he is promoted to a master mechanic, he has only a hazy conception of the nature of the work and importance of the car department. It is the purpose of this paper, through a discussion of some of the problems encountered, to call attention to the necessity for a more complete and accurate knowledge of car work.

There are operating today on the railroads of the United States approximately 2,000,000 freight cars, the cost to maintain each of which is estimated at from $80 to $100 per year. Assuming $90 as an average figure, the total amount expended annually in the United States for repairs and inspection of cars is approximately $180,000,000. This is no inconsiderable part of the total spent for the maintenance of equipment. A recent comparison made of the car and locomotive department payrolls on a certain part of one of the large railroads showed that the car department averaged 40 per cent of the total, and the locomotive department 60 per cent. The following itemized cost of operating a freight train of 50 cars 100 miles furnishes another indication of the relative amount of money spent in each department:

Locomotive maintenance	$12.97
Fuel	10.44
Freight car maintenance	55.10
Total	$78.51

Although the nature of the work is considerably rougher and can be handled to a large extent by unskilled labor with a smaller investment for equipment, it does not necessarily follow that the problems that must be met and solved are any the less important or any the less difficult to solve. In a number of ways the larger problems are very similar to those in the locomotive department.

However, in at least one important feature car work varies from locomotive work entirely, and that is in the repairs to foreign cars. The M. C. B. Association has formulated a

TIME STUDY

SHOPS DATE 4/7/16

CLASSES All Classes of Wooden Baggage Cars.

NAME OF PART Cap & baggage side door step.

PAT. No. B.P.No.

No. OF PIECES 4 MATL W. I.

OPERATIONS Remove wood & Apply W.I. Cap inc., bolt for hand hold.

WORKMAN. RATE D.W. CHK. No.

WORKMAN. RATE D.W. CHK. No.

WORKMAN. A.A. Bennett RATE D.W. 26½ CHK. No. 3589

TIME COMMENCED 8 ST TIME FIN. 10 23

OPERATIONS	TIME ACT.	TIME MIN.
Get material on platform	8 59	5
Remove 1 wooden step Cap	9 4	5
Fit iron Cap	9 5	1
Get material from store house	9 8	3
applied Cap - 12 No. 14 screws	9 21	13
Removed 1 wooden Cap	9 25	4
applied 1 iron cap	9 42	17
Removed 1 wooden cap	9 46	4
applied 1 iron cap	10 1	15
Removed 1 wooden cap	10 6	5
applied 1 iron cap	10 19	13
		85

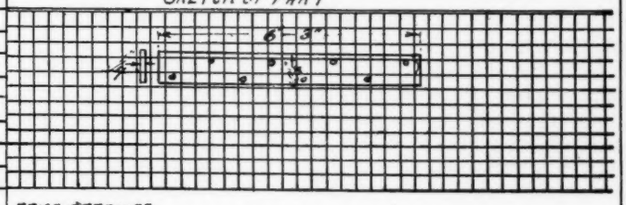
OPERATIONS — TIME ACT. / MIN.

BRT. FWD.

SUMMARY OF OPERATIONS

	MIN.		
DELAYS		ALLOWED TIME	84
		No. OF PIECES	4
		AVG TIME PER PIECE	
		PRICE PER PIECE	
		PREVIOUS PRICE	
		TIMED BY J.C.A.	
TOTAL		REMARKS	
ACTUAL TIME	85	A.K.	
TIME DEDUCTED FOR UNNECESSARY DELAYS	4	M.H.	

SKETCH OF PART



PRICE APPROVED

MASTER MECHANIC

FIG.

Fig. 1—Form Used for Establishing Piece-Work Prices

However, in at least one important feature car work varies from locomotive work entirely, and that is in the repairs to foreign cars. The M. C. B. Association has formulated a

code of rules governing the interchanging of and repairs to freight cars. Each railroad company is expected to give to foreign cars while on its line the same care as to inspection, oiling, packing, adjusting brakes, and repairs that it gives its own cars.

Considering that approximately $180,000,000 is expended annually by the railroads of the United States for repairs to freight cars, and that conservatively estimated 20 per cent of this amount, or $36,000,000, involves repairs to cars on foreign roads, and considering also that this enormous sum of money is exchanged between railroads without any definite means of checking against the work performed by repairing lines. It will be realized that the repairing of foreign cars and billing for the repairs occupies a unique position in business. There is perhaps no other line of business where such large sums of money are exchanged merely on the basis of common honesty. In order to protect the car owner, and that the principles upon which this important branch of railroad work are founded may be safeguarded, two things are necessary: First—adequate supervision; second—a thorough and efficient system of preparing original records and compiling charges from such records.

Training Car Inspectors.—It is no small part of a car foreman's duty to assure himself that his inspection forces are thoroughly familiar with and able to apply the M. C. B. rules governing the interchange and inspection of cars, the United States Safety Appliance Act, the Loading Rules of the M. C. B. Association, and the Tank Car Specifications. The best and easiest method to accomplish this is to see to it that the men who are promoted to inspectors have received proper training. A car inspector must be able to discover the parts which have actually broken down and defects which may develop into subsequent failures.

A car inspector should know something of the way in which repairs are handled on the repair track, and inasmuch as he must make repairs himself, it is almost a necessity that he be a proficient repairman. After being picked out as a prospective inspector, he should be moved about on various classes of work, so that when the time comes to use him as an inspector he will have had some training on every class of work, on truck work, on steel cars, on wooden car repairs, on light repairs to loads and empties. Some roads hold written examinations on the M. C. B. rules and all other rules governing the inspection of cars at stated intervals. Other roads have a division general car inspector whose duty it is to go from point to point where inspectors are stationed and by questioning ascertain whether or not the inspector has a reasonable working knowledge of the rules, and whether he is able to apply them. The training of a car inspector is by no means a simple task. It requires thought and careful attention. Once it is accomplished in a satisfactory manner, it requires more careful attention on somebody's part to see that the inspector does not become lax and inattentive.

Hot Boxes.—Hot boxes are a source of expense, which, if they could be eliminated entirely, would save considerable money in the course of a year. The average cost of a hot box is estimated at approximately $10. This figure includes the cost of necessary switching and repairs, but does not include any of the expense incurred in wrecks, consequent delays to traffic, etc. Using this figure as a basis of an estimate, the total cost of hot boxes represents approximately 8 per cent of the total repair expense of the car.

The principal causes of hot boxes are:

1. The shifting of the sponging towards the outer end of the journal box, due to the lateral motion of the box, which draws the sponging away from the rear of the journal. An examination of the bearings and axles removed on account of hot boxes will show that heating in the majority of cases began at the rear of the journal.

2. Sponging too tight, due to excessive amount of waste. In forcing the waste into the box, the oil in the waste next to the journal is forced out through the opening between the dust guard and its seat, the dry waste then acting as a wiper. It not infrequently happens, where this condition exists, that strands of waste are drawn up between the journal and the bearing, in which case a hot journal results.

3. Sponging glazed due to the waste not having been agitated, or set up with a packing knife at frequent enough intervals. Where this conditions exists, the oil cannot reach the journal.

4. Insufficient amount of oil in the sponging, due to its being syphoned away by loose strands of waste hanging out of the box. This condition may also be brought about by an accumulation of snow in the box. The snow melts from the heat of the journal, the water collecting in the bottom of the box lifts the oil and allows it to escape.

5. An excessive amount of oil which results in the waste falling away from the under side of the journal.

6. Worn out sponging. This results in practically the same defect as when an excessive amount of oil is used with good waste. The packing having lost its life, falls away from the

.....Division.

LUMBER INSPECTION CARD.

Car No. 324391 Initial, C.R.R.

From.....

Received,.....

PIECES. Good	PIECES. Culled	SIZE	KIND	FEET. Good	FEET. Culled
		3¼ x 8 x 7	Ol. Oak		
5		12¼ x 14¼ x 9'9	" "	709	
7		10¼ x 12¼ x 8'9	" "	831	
4		4¼ x 14¼ x 10	" "	174	
1		7½ x 12½ x 10	" "	78	
4		5¾ x 7¾ x 7	Sh. "	104	
1		6¾ x 7¾ x 7'6	" "	33	
17		2¼ x 4¼ x 9	" "	107	
17		3¾ x 3¾ x 8	" "	160	
2		4 x 5 x 8	" "	27	
5		5¼ x 5¼ x 8	" "	92	
4		11¼ x 13¼ x 8	" "	398	
15		1¼ x 6 x 8'6	" "	111	
		2¼ x 4¾ x 8'6	" "		
10		3¾ x 6¼ x 8'6	" "	166	
9		4¼ x 8¼ x 8'6	" "	224	
6		2¼ x 16¼ x 8'9	" "	101	
17		3¼ x 14¼ x 8'9	" "	413	
11		1 x 9½ x 9	" "	78	
1		3½ x 4 x 9	" "	11	
8		4¼ x 12¼ x 9	" "	210	

Total, 4029

Shipper's Claim.....

Excess or Deficiency,.....

Inspected by J. Elman

Correct:.....

Date, 5/24/1916 Foreman.

Fig. 2—Form Used for Recording Inspection of Lumber

lower side of the journal, leaving it without a means of lubrication.

Preparation of Sponging.—The proper preparation of the sponging is important, both as a means of preventing an unnecessary waste of oil and in eliminating a frequent cause of hot journals. The waste used should be free from all foreign substances. Care should be exercised to see that the quality of oil presented for summer or winter use is used in the proper season. The waste and oil should be mixed in the proportion of 80 lb. of waste to 90 gal. of oil to insure a thorough saturation of the waste. This mixture should stand for 48 hours in a room in which the temperature is kept at from 68 to 70 deg., after which 50 gal. of oil should be drawn off, leaving the ingredients in the proportion of one gal. of oil to 2 lb. of waste, or 4 pints of oil to 1 lb. of waste. This should leave the packing in a condition so that when it is compressed in the hand the oil will just appear between the fingers.

Car Apprentices.—The apprenticeship system in the car department on some roads has declined to a point where there are few, if any, apprentices enrolled. The exact reason for this is not apparent. The need of apprentices is fully as great today and even greater than it was 10 years ago. If the ever-increasing cost of repairs is to be cut down to any appreciable extent, it must come about through the efforts of a more capable and better trained force than our present one. Old methods and old ideas must give way to improved ones.

An adequate apprenticeship system should provide for:

1. A sufficient amount of time spent in each department to give the apprentice a clear idea of that part of the work.
2. A rate of pay which would attract boys of some education.
3. Promotion for the better grade of apprentices.

The scheme adopted in most locomotive repair shops of having a definite schedule, according to which an apprentice serves a set amount of time in each department, ought to be just as applicable in the car department. A proposed schedule of this kind is given below.

FIRST YEAR

Freight car repair tracks	6 months
Passenger car repairs	6 months

SECOND YEAR

Pipe shop	3 months
Tin shop	3 months
Smith shop	3 months
Planing mill	3 months

THIRD YEAR

Car machine shop	3 months
Paint shop	3 months
Air brake work	6 months

FOURTH YEAR

Inspection of freight cars	6 months
Inspection of passenger cars	6 months

Piece Work.—Piece work in railroad shops has been in general use throughout the country for about thirty years, and yet it appears in the light of what has been accomplished in the industrial concerns that this important subject deserves further consideration. In most shops it is customary when a new price is to be established for performing an operation to set it in one of four ways: by a comparison with a price already in use in some other shop, or from an estimate of the time required to perform the operation as made by the foreman of the department affected, or through the action of a committee of department foremen from two or more shops, or by what is known as a time study or an accurate record of the time required to perform any one operation, taken by a man who has nothing else to think about save the particular operation upon which he is taking time.

It has gradually become apparent that the first three methods fail completely to meet the needs of the situation, and on some few roads an entirely different and more accurate method has been instituted. Men have been chosen from among the workmen whose duty it is to devote their entire time and thought to the accurate setting of prices and to their payment. To accurately set the price, it is seen that the workman first provides himself with all the necessary tools and material to complete the operation. The workman is shown just how each operation is to be performed. Upon a blank form, a sketch of which is shown in Fig. 1, is entered the time required to perform each operation. If the operation is one which, if repeated, could be performed in the same length of time, the price is set on the basis of the time shown, with the time consumed in unnecessary delays deducted, basing the price upon approximately 40 per cent to 60 per cent in advance of the prevailing day rate for that class of work. But if the job is of such a nature that the time consumed in performing the same operation again would vary, as for instance in stripping, where nuts come off readily in some cases and must be split in others, a number of observations are made of the time required, and the price based on the average condition as indicated by these time studies. After the price is once set, these forms are filed away so that at any time where a question arises as to what was included in the price, reference can be made to the form.

Dismantling Cars.—With the increase in prices paid for scrap material, both for lumber and metal parts, the question has again arisen as to whether more economy could not be shown if cars were torn down and all material saved than if they were burned down, and some material wasted to save the increased labor cost of tearing down the cars. Up to this time it has always been felt that it would cost more in labor to reclaim such material than it was worth. Recent investigations seem to show that this is not the case. A study made on the comparative saving effected in burning and tearing down a number of box cars shows a distinct saving effected through tearing down the cars, as follows:

	Car cut up by hand	Car burned
Value reclaimed metal material	$33.592	$33.592
Lumber reclaimed	23.25	7.56
Scrap credits	23.12	23.12
Total value of all material reclaimed	$79.962	$64.272
Cost to destroy	9.00	8.64
Net value of reclaimed material	$70.962	$55.632
Saving effected by tearing down cars, Per car torn down	$15.33	

The work of tearing down these cars was all done day work with considerable room for improvement in methods and in the amount of material saved. The proposed plan of handling the work was as follows: Secure enough cars to fill one or more tracks with from 10 to 20 cars each, spacing them about 10 ft. apart; assign four men to each car, two of them to begin stripping off the roof and two to removing grab irons, brake staff and outside metal. The men removing the roof could, before leaving the top of the car, loosen the siding. After removing the roof, outside metal and doors, the four men could then take down the lining, loosen the belt rail and remove the siding. The upright rods should be cut at the floor level, the longitudinal rods should be taken out, the frame work thrown to the ground and the rods still remaining in the frame driven out. Two men could then remove the deck, while the other two men take down the draft rigging and remove the air brake material.

The work of cleaning up the track, assorting the metal, classifying and piling the lumber should be done by another gang of two men to each car. With this organization it was estimated that a gang of 6 men ought to tear down and pile and assort all the material from one car in eight hours.

There are a variety of uses to which reclaimed lumber can be put. The siding can be used for roof boards and for sheathing of buildings; car lining can be used for sheathing car sills for foundation work and framing. Car decking can be used for platforms. The scrap lumber is worth about $2 a cord in the market, or about $1 per car. The second-hand lumber can be estimated at about $10 per 1,000 ft. reclaimed. The metal parts are in much better con-

dition for use when cars are torn down instead of being burned. From all the figures available, it appears that considerable economy can be effected by abandoning the practice of burning condemned cars.

Handling Lumber.—The value of the lumber handled in the average lumber yard connected with the car department will approximate $20,000 a month, or $240,000 annually. All lumber should be inspected on its receipt to insure that none is paid for which is not received, and that that which is not in accordance with specifications is rejected. Rejected lumber may be accepted at a lower price, and used for purposes other than that for which it was originally intended. A form which has been used with considerable success for recording the results of such an inspection is shown in Fig. 2. This form is printed on heavy glazed cardboard, and is made of a convenient size for the inspector to hold in his hand.

To economically purchase lumber for the large variety of purposes it is used for in the average car department, and to insure that the particular sizes are purchased on which there is the least waste in cutting it to the desired dimensions, requires a complete system of records. The records must be kept so that the total consumption of any one size can be accurately estimated for any stated period, as well as the amount on hand and the amount due but not received.

Car lumber yards must be arranged to fit local conditions, such as ground space available, track layout, convenience of delivery to shops, switching facilities, etc. In the arrangement of the piles the timber should be supported at enough points to prevent breakage, to permit a free circulation of air and to keep the timber drained of all moisture. The foundation should be arranged so that the bottom of the pile sets from 2 to 3 ft. above the ground to permit a free circulation of air underneath the pile and should be pitched so that the front end is higher than the rear end. The amount of this pitch varies, but successful results have been obtained where the pile is given a pitch of about 1 in. per foot. This amount will insure sufficient drainage and prevent any accumulation of moisture. Hardwood should be stripped every third tier, enough space being allowed horizontally between boards to allow a sufficient circulation of air. This supports the timber throughout its entire length, and still exposes enough surface to the air for drying. Dressed roofing, siding and lining should be stripped every other tier. It has been found that if dressed siding is stripped every tier a number of broken boards result.

SPECIAL TOOLS FOR STEEL CAR REPAIRS

Beginning on page 470 of this issue there is published a report of the recent convention of the American Railway Tool Foremen's Association. While there are many car department officers and men who will be interested in the entire proceedings of this convention, special attention is called to the discussion on Special Tools for Steel Car Repairs, which appears on pages 472, 473, 474 and 475.

Allowable Strength of Welded Joints.—According to the A. S. M. E. Boiler Code, "the ultimate tensile strength of a longitudinal joint which has been properly welded by the forging process shall be taken as 28,500 lb. per sq. in., with steel plates having a range in tensile strength of 47,000 to 55,000 lb. per sq. in."—*Power.*

Zinc Concentrate Imports.—A steamship load of Australian zinc concentrates consigned to the American Steel & Wire Company at Donora, Pa., arrived at San Francisco recently and was transferred into 141 cars and forwarded overland by the Atchison, Topeka & Santa Fe in four solid trains. From Chicago the freight went by the Pittsburgh, Cincinnati, Chicago & St. Louis. It is understood that this steamer will be followed by many others with similar shipments.

SUGGESTIONS FOR THE CAR DESIGNER*

BY CYRUS HANKINS

One may safely say that there are no perfectly designed cars nor any perfect car designers. There are, however, cars of designs so much better than others that it is plain to see the designers were capable and well qualified. It should be the aim of every designer to become equally as capable, and it should be the aim of every railroad to secure qualified men.

The gravity of poor design is too often not appreciated by the unfitted designer, and too often to the officers of a road any car is a car. But if all designers could fully appreciate that even the least excess of metal makes an addition to the first cost that is really astonishing and each year that extra weight, in many ways, is eating into the company's revenue, it is certain they would study to eliminate much unnecessary weight and expense. There are often cases where by better designing, a car, weighing, say, 45,000 lb., could have been made stronger and better fitted for service, with a saving of probably 2,000 lb. in light weight. This, depending on the market, would amount to from $25 to $40 per car for steel alone, and there are often 10,000 cars built from a single design.

The designer must be an engineer. A draftsman without any engineering knowledge may duplicate some other design of car and rearrange it to take certain standards common to his road, but that is about as far as he is able to go.

The designer must make a very careful study of the conditions under which the car may operate and the requirements that it must meet. He can get many valuable hints on what to avoid by careful observation of cars on the repair track. By a study of the Car Builders' Dictionary and of railway mechanical periodicals, a knowledge may be obtained of the typical designs of the past. There is no source of information so valuable to the car designer as the careful analysis of previous designs, especially if he has available information as to their service record. The designer should not, however, fall into the rut of designing only by proportionately increasing old designs and not giving himself the chance to do any original work. He must not blindly follow any old design, but learn to determine the functions of each part and design accordingly.

A thorough familiarity on the part of the designer with the practice of the local shops and with their limitations is essential. It is well to consider carefully any suggestions coming from the shop and incorporate them in the design wherever possible, not only for the value of the suggestions themselves, but for the psychological effect on the men who will have to deal with the cars after they are built.

The designer should not be compelled to use specialties which he knows are not suited to the car in question. Very often they are specified, even against the advice of the mechanical department, certain devices that subsequently prove to be worthless. The designer should at least have a voice in the selection of every specialty that goes on the car. Often the substitution of one commercial device for another will be of great assistance in working out other details of the design.

The car designer must not only be capable, but must be allowed time in which to do his work. No designer can get the best that is possible on his first trial. He should have time to make several study designs before a working design is finally selected.

Timber Preservation.—To preserve timber from decay it is treated with an antiseptic, such as creosote or zinc chloride. Creosote is the oldest known preservative and one of the best. Creosote oil is insoluble in water, and has a boiling point of over 4,100 deg. F.—*Power.*

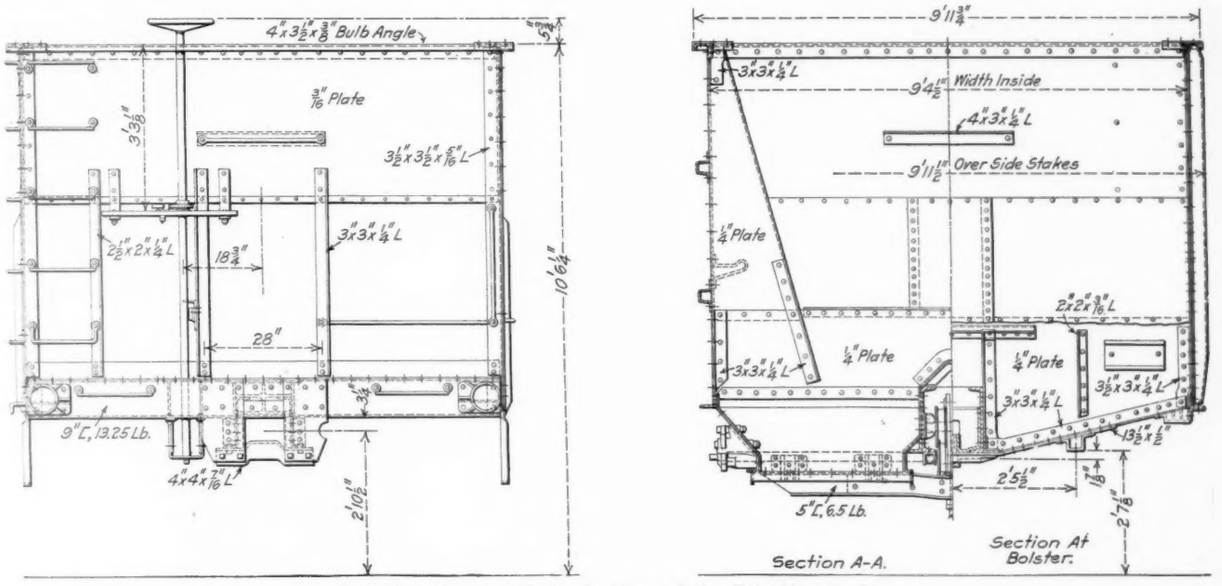
*Entered in the competition on "How Can the Car Designer Improve?" which closed June 1.

Erie Railroad 50-Ton Hopper Cars

Self-Clearing, Triple-Hopper Arrangement; Special Attention Has Been Given to the Side Bracing

THE standard design of car used by the Erie Railroad for transporting coal is a self-clearing triple-hopper-bottom car. By referring to the photograph and drawings of one of these cars, 1,000 of which have recently been built by the Pressed Steel Car Company, it will be noted that therefore, the lading can be discharged more rapidly and with less labor.

These cars have a special feature in the construction and bracing of the sides. Where outside vertical stakes and inside tie braces tying the sides together are used they are



End Elevation and Cross Sections of the Erie Hopper Car

the bottom is equipped with three sets of doors. Each opening is provided with two doors hinged crosswise of the car. The doors are opened in multiples of four; that is, two pockets, one on each side of the center sill, are operated from

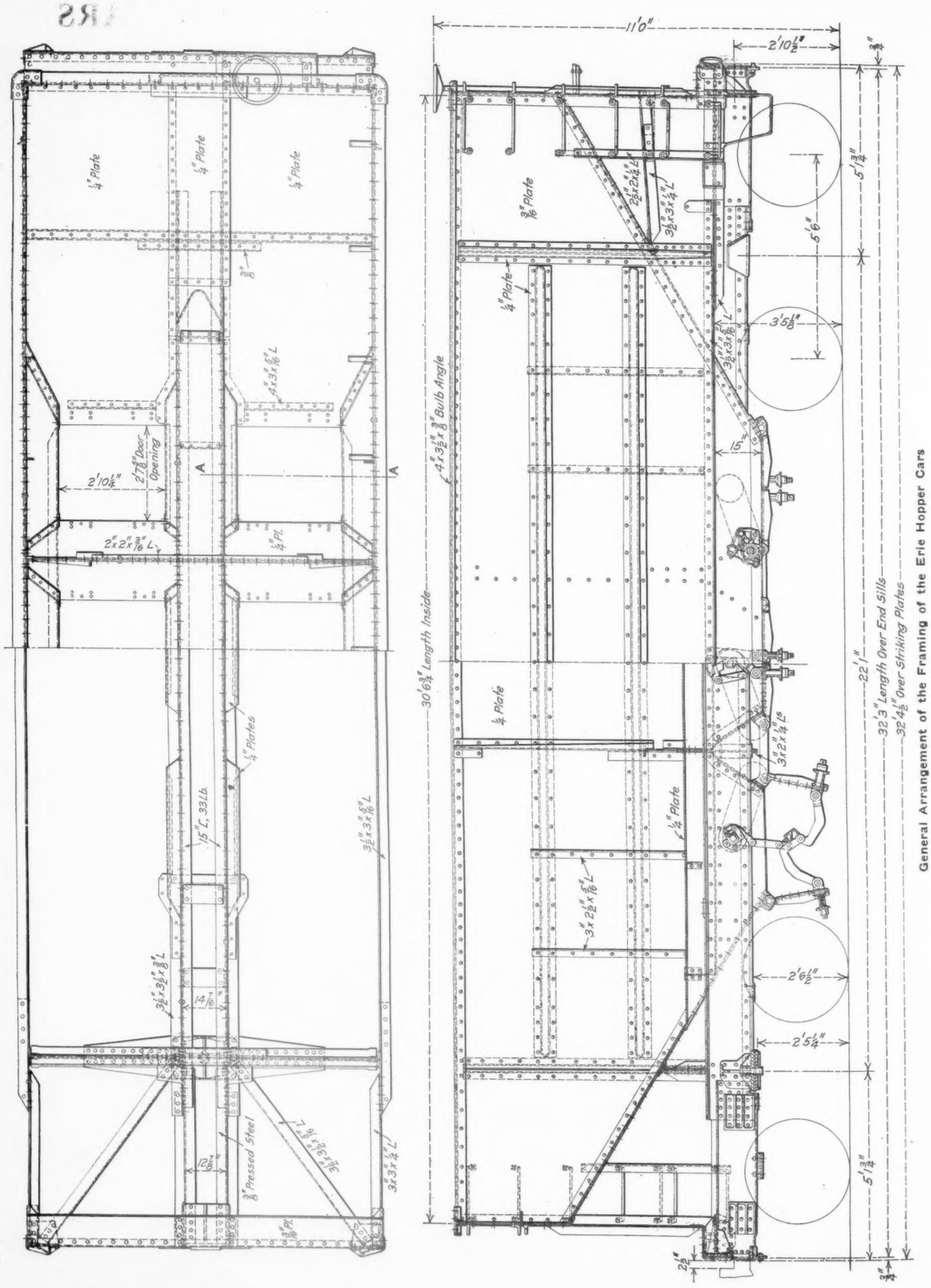
sooner or later damaged, the side stakes from being side wiped and the tie braces from the lading. The sides on these cars are braced differently from the usual practice, and instead of using outside vertical side stakes spaced at regular



Erie Railroad 50-Ton Capacity Hopper Car

one operating shaft. With this arrangement of hoppers, large and direct openings for discharging the lading are obtained. The total opening is from 30 to 50 per cent greater than with the standard double hopper bottom type of car and,

intervals between the bolsters, and bracing the sides by tying them together with tie braces, the main bracing on the outside is longitudinal and on the inside vertical. There are two pressed steel stakes on each side, one at each bolster. These



General Arrangement of the Framing of the Erie Hopper Cars

two stakes are well braced, being anchored to the end of the body bolster girder. Between the bolsters the sides are braced on the outside with four longitudinal members. One is at the top of the car and consists of a 4 in. by 3½ in. by 1½ in. by ⅜ in. bulb angle, continuous from corner post to corner post. At the bottom of the side is a 3½ in. by 3 in. by 5/16 in. rolled angle continuous between points just beyond each body bolster. Between these two rolled members, and spaced about equally, are two pressed steel stiffeners extending from bolster to bolster. On the inside there are two heavy triangular-shaped gusset plate braces. These extend from the top of the sides to the cross girders and have a width at the bottom of about one-half the distance between the side and center sills. There are four additional vertical stiffeners, made of angles, on the inside and spaced equally between the bolster and the triangular-shaped gussets. It is found that this construction stands up very well and repairs are small when compared to the usual construction of having all vertical side stakes on the outside, and inside cross tie braces.

With the exception of the end sheet, the end side sheet and the end sill cover plates, which are 3/16 in. thick, the plates used throughout are ¼ in. The cross ridges, which at the same time form cross girder constructions, each consist of a vertical web plate running from side to side of the car and extending from the bottom to about 20 in. above the top of the center sills. These are reinforced at the bottom with two angles, extending from side to side, which pass below the center sills, and at the top with an angle extending between the side gusset plates which are attached to the top of these plates. To this plate, about in line with the top of the center sills, are also attached four sheets which slope down to and form one side of the door opening to which the drop doors are hinged.

The center sills consist of 15-in., 33-lb., rolled channels, with the flanges turned in, reinforced at the bottom on the outside with a 3½ in. by 3½ in. by ⅜ in, angle extending from draft rigging to draft rigging. To these sills, in front of the body bolster, are spliced ⅜ in. thick pressed steel draft sills. The body bolsters are of the usual single web construction. The end sills consist of 9-in., 13¼-lb., rolled channels, backed by a heavy steel casting behind the coupler horn striking face.

The specialties used are New York air brakes, Simplex, Gould and National Malleable Castings Company's couplers, Reliable uncoupling device and Miner friction draft gear with forged steel yoke. The trucks are of the cast steel side frame type, having 5 in. by 5 in. by ½ in. spring plank angles, and are equipped with Simplex bolsters having Miner side bearings, M. C. B. brake beams, steel back brake shoes, Barber roller device, cast iron wheels, Gould journal boxes and drop forged wedges.

The length of the car over coupler striking faces is 32 ft. 4½ in., the height from rail to top of side 10 ft. 6¼ in. and the width over-all 10 ft. ¼ in. The cars are of 100,000 lb. capacity, level full, hold 1,880 cubic feet and have a weight of 41,000 lb.

PIPE MATERIAL.—Pipes and tubes are made of a great variety of materials, the most common being iron, steel, copper, brass, lead and tin. In recent years two or more metals have successfully been mechanically combined as a lining or covering for special purposes, aside from galvanizing, tinning or plating by the hot process or by electrically depositing one metal upon another.—*Power.*

REMOVING PULLEYS.—Removing pulleys that have been rusted on shafts is frequently a troublesome job, but can generally be accomplished by heating the hub with a charcoal fire or some other means. The hub will expand, and the wheel can be easily removed. Care should be taken, however, not to heat the shaft, for if it expands as much as the hub nothing is gained.—*Power.*

METHOD OF PACKING JOURNAL BOXES*

Where it is necessary to entirely repack a journal box, all of the packing should be removed and the box carefully cleaned of all grit and dirt. A handful of packing, rolled and twisted into the form of a rope, should be inserted first in the back of the box to act as a dust guard as well as filler. The box should then be filled with sponging up to the center of the journal, the centering hole in the end of the axle serving as a guide for the proper height. Care should be exercised to keep the packing inside the journal collar, and that the box is not too tightly packed. A handful of packing should then be placed in front of the journal as a wedge to keep the packing on the sides in place. This should have no connection with the packing on the sides or beneath the journal. Care should be exercised to see that no loose ends of the packing hang out of the box which can act as syphons to draw the oil out of the box.

It is important that the box be not filled above the center of the journal as packing above that point is liable to be caught and drawn in between the journal and the bearing, producing friction, which results in numerous hot boxes. A box thus packed should be in condition for 6 months' service without complete repacking. At the end of every 400 miles, however, the packing should be sponged, i. e., the well saturated and fresh packing should be brought up from the bottom of the box to the underside of the journal.

STEEPER END SLOPES FOR HOPPER CARS

BY F. S. INGOLDSBY

The fundamental of a dump car is to dump; but many railway officers content themselves with cars which are partial dumpers, when for the same money they could have complete dumpers. It is just a matter of placing the end slopes at the proper angle of inclination, so that the entire load will run out when the doors are opened.

By examining the general run of coal cars in service it will be found that their end slopes are only 30 deg. from the horizontal. Watch the unloading of such cars; from two to eight men are employed, and from the moment they begin on a car until they are through with it they consume 40 min.—the eight men taking 5 min., or the two men 20 min. Multiply this 40 min. for the one car by the thousands of unloadings which occur daily on the railroads throughout the country and the waste of time and money is seen to be enormous.

By simply steepening the end slopes this time can be reduced to one minute per car; but so long has this faulty design been adhered to, that the 30 deg. end slope is accepted by the majority of railway officers as inspired. However, it can be changed, and it has been changed, notably on a large number of cars which have been running on the Chesapeake & Ohio for more than two years.

Until 1913 the 30 deg. end slope was accepted on the Chesapeake & Ohio the same as elsewhere, but Frank Trumbull, chairman of the board of that road, led those under him to question its sanctity, and as a result the cars ordered at that time were changed so that their end slopes were 20 deg. steeper, or 50 deg. from the horizontal, notwithstanding the fact that car builders and others said it could not be done. These cars have a rated capacity of 70 tons, and one of them has been loaded with 79.9 tons of soft coal, thus proving that the cubic capacity was more than ample for the rating. No doubt when these facts become well known it will not be long before practical tests of the two slopes will be made by other railroads, and once that is done there will be no more 30-deg. end slopes to eat up the time and money of our coal-carrying railroads.

*From a paper on Car Department Problems presented by E. E. Griest, master mechanic, Pennsylvania Lines, Ft. Wayne, Ind., at the General Foremen's Convention.

THE READJUSTING OF YARD INSPECTION FORCES

BY J. E. HELMS

It is probable that the handling of both freight and passenger trains through yard terminals with men classed only as car inspectors, has never been tried to any large extent in a practical manner. The practice adopted in the majority of yards is to have men who do the inspecting; oilers who do the oiling, repacking and rebrassing; air brake men who make repairs and test the air brakes on trains leaving the yard; and light repair or safety appliance men who look after safety work.

This necessitates in the handling through any yard of, say, 12 or 15 hundred cars each 24 hours, a force of 10 inspectors, 5 or 6 air brake men, 4 oilers and 2 or 3 safety appliance or light repair men. Classifying men in this manner is very good, providing the work to be done comes in gradually and moves out in the same manner, but when the yard becomes congested, as it does every day, especially in freight yard service, it is almost impossible to accomplish the work with any degree of exactness, simply for the lack of not being able to place the yard men most effectively on account of their classification. With all of the men classified as car inspectors, each one competent to do any kind of work, the work could be performed much more expeditiously than it is now.

The argument may be put forth that the additional cost in wages would make this plan unprofitable. With proper supervision of the men, when once the plan is inaugurated, it would expedite the handling of cars and trains to such an extent through most yards that much of the waste time in getting cars in and out of terminals would be avoided, with a consequent saving for the operating and traffic departments.

CO-OPERATION IN DESIGNING CARS*

BY A. H. LAKE

My experience as a car draftsman leads me to believe there is not a sufficiently close relationship existing between the railroad drafting room and the departments using and repairing the cars.

The draftsman has very little opportunity to see the cars, the drawings of which he has made, either during their construction or after completion, the inspecting generally being done by men who never visit the drafting room. While the inspectors give many valuable suggestions, these suggestions pass through so many hands that by the time they reach the draftsman they have lost most of their value. This also applies to the suggestions from the operating department.

The principal car shops and repair tracks often are not located at the same point as the drafting room. The result is that a great many changes are made on the cars of which the draftsman has no knowledge and when he prepares a new design he may make use of details and specialties that have proved wholly unsuited for the conditions of the service. The principal car shops, repair tracks and drafting room should be located at the same point, and the draftsman should have access to the shops at any time during working hours. He should visit the shops several times during the course of construction or repairing of cars in the design of which he has taken part, thereby becoming familiar with shop methods and noting any defects which may have developed in service in order that they may be avoided in the future. The shop foremen and inspectors should have access to the drawing room at all times and so familiarize themselves with the problems which confront a draftsman. Only by the establishment of such relations between the men who repair the cars and the men who design them can the existing conditions be improved.

If a large number of cars are being built at an outside contract shop to the drawings and specifications of the railroad company, it would be advisable to have one or more of the draftsmen who worked on these drawings act as inspectors for a short time during the construction of the cars, thereby getting some knowledge of their shop methods.

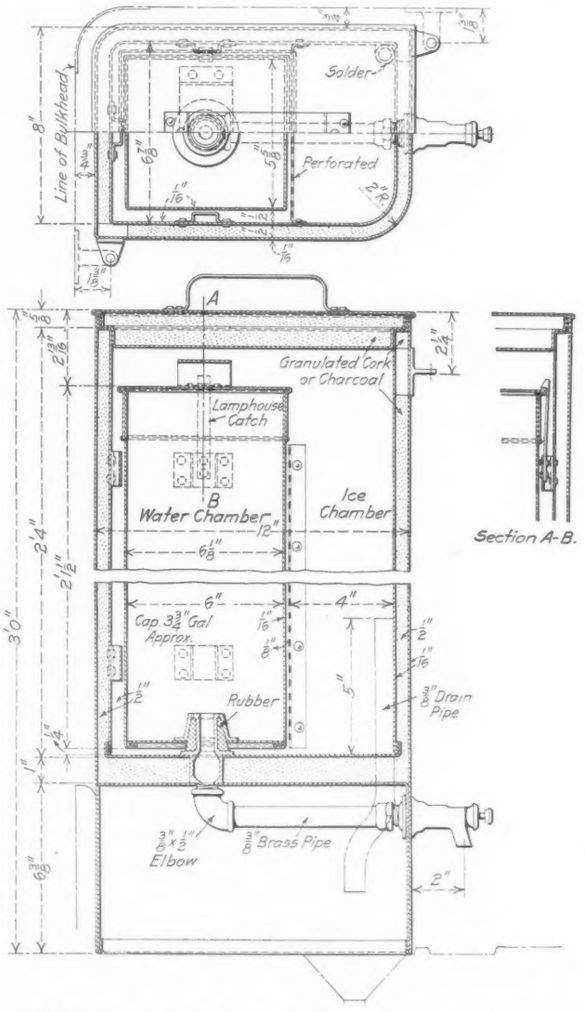
*Entered in the competition on "How Can the Car Designer Improve?" which closed June 1.

WATER COOLERS FOR PASSENGER CARS

BY GEORGE E. McCOY

Assistant Chief Draftsman, Canadian Government Railways, Moncton, N. B.

The accompanying illustration shows a design of water cooler which has recently been applied to an order of steel sleeping cars, built by the National Steel Car Co., Limited, Hamilton, Ont., for the Canadian Government Railways. The outer tank which holds the ice is built with double walls, between which is placed the insulating material, either granulated cork or charcoal being used. The water container is placed within the ice tank and a socket in the bottom fits over a taper rubber plug surrounding the outlet to the faucet. This provides a tight joint, without in any way interfering with the quick removal of the tank. It will be noted that the ice is separated from the water tank by a perforated plate which prevents the latter from being injured by coming into contact with the ice.



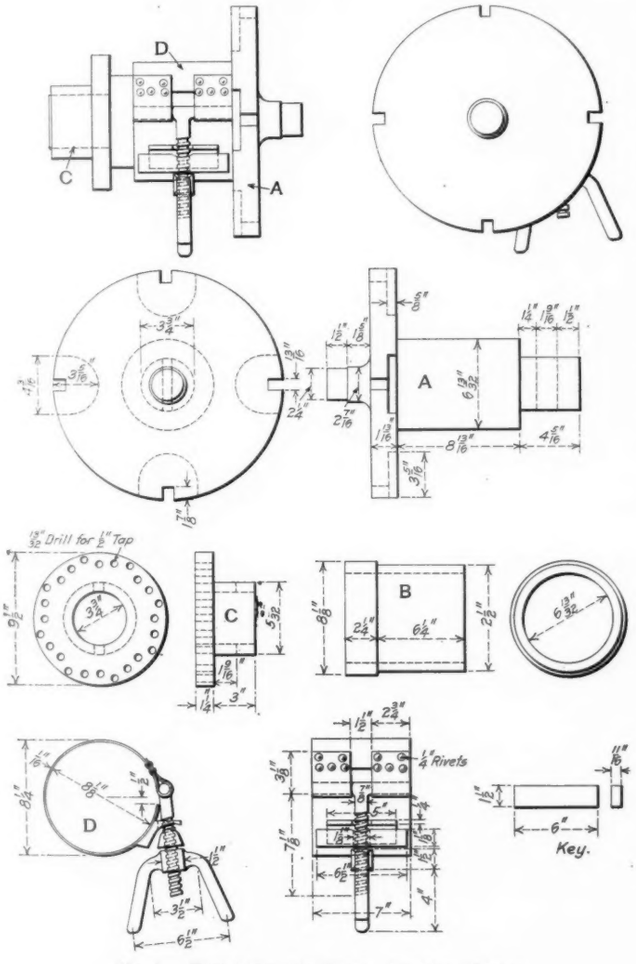
Water Cooler Used on Canadian Government Railways

Shop Practice

FINISHING AIR PUMP PACKING RINGS

BY F. R. STEWART

It has long been the practice to turn air pump packing rings after they have been cut at the proper angle, but most of the methods used are slow and inaccurate, especially so if the piece cut out is 3/8 in. or more for rings 8 in. to 9 in. in diameter. This practice means longer life for the cylinder, and greater efficiency for the pump, and in order to maintain this efficiency, cylinders should be rebored when



Jig for Finishing Air Pump Packing Rings

slightly out of round, thereby keeping the rings and cylinders to a perfect bearing at all times.

It is the practice of one railroad to rebore cylinders that are found to be 1/32 in. out of round, and to bush a cylinder when worn 3/16 in. larger than its nominal diameter. Rings are made to fit these rebored sizes, so it is necessary to have a chuck which is easily adjustable to turn rings with outside diameters increasing by steps of 1/32 in. This is accomplished by means of the chuck shown in the drawing, which is fitted to a Bullard vertical turrent lathe with constant speed motor and quick changes of table speeds.

The chuck is made up of a mandrel *A*, a sleeve *B*, and the cap *C*, the last being placed on the mandrel after the bushing and held in place by a key of rectangular section, which passes through the cap and the end of the mandrel. A set of sleeves is provided, the outside diameter of the bodies being turned to the inside finished diameters of the packing rings. Where the packing ring diameters vary between wide limits it may be desirable to build out for the larger sizes with concentric sleeves in order to avoid the heavy handling necessary if one sleeve only were used for each size of ring.

The mandrel is clamped to the boring mill table with four bolts through slots in the flange. Below the flange is an extension which fits the table spindle, thus insuring accurate centering with a minimum expenditure of time. With the sleeve in place on the mandrel, packing rings are applied until the last one projects from 1/16 in. to 1/8 in. above the top of the sleeve, the joints of adjacent rings being quartered. The band clamp *D*, details of which are shown, is then placed around the rings and they are drawn tight against the sleeve by turning the nut on the square threaded screw. Cap *C* is then secured in place and a number of 1/2-in. set screws drawn down against the top ring. When these are tight the clamp may be removed and the outside of the rings turned. The shoulder at the lower end of the sleeve is 1/32 in. less in radius than the outside of the ring and provides tool clearance at the end of the cut.

After a chuck full of rings has been finished the set screws in cap *C* are slacked back, thus permitting the removal of the key, the cap and the finished rings, and the application of another set. From 70 to 90 rings can be turned per hour, depending on the size.

ENGINEHOUSE METHODS*

BY J. S. BREYER

Master Mechanic, Southern Railway, Charleston, S. C.

The successful handling of an engine terminal, be it large or of medium size, requires a man to oversee it who possesses very strong executive ability. He is daily dealing with all classes of men. Enginehouse foremen, as a rule, are drawn from the ranks of the machinists; however, this is not necessary, as I have known successful foremen who were boiler makers, carmen, machinist's helpers, and callers. It is very desirable that they have a fair working knowledge of all trades employed in railway shops, and a personality that will enable them to command the respect of everyone with whom they come in contact. With a man of this caliber in charge, and a corps of loyal and energetic sub-foremen, a volume of business can be handled so economically that it would surprise the average business man who is not conversant with railroad operation. To help in obtaining these results I would suggest that all enginehouse foremen read every issue of some good mechanical paper and the proceedings of the different conventions of the railway organizations, in addition to studying their force and facilities.

All enginehouse work, as far as possible, should be spe-

*Entered in the competition which closed February 1.

cialized; driving boxes, shoes and wedges, and rods and crosshead work should be cared for by the same men. Safety valves, steam gages, and cab valves should be taken care of by an assigned force of men, and so each group of work should be taken care of by the same group of men each day, and the men held responsible for the condition of that particular part of the engine. By so doing, the engines can be kept in service instead of in the back shop, and a great many engine failures prevented. It is sometimes difficult to make some men accept responsibility, but this is essential if it is expected to have a nearly perfect organization.

The expensive part of enginehouse organization lies in the unskilled labor, and here is where a foreman can bring about economical operation. Analyze your force of packers; you may find a man packing tank boxes and another driving boxes, and still another filling rod cups, perhaps each reporting to a different man. Put all of the packing together, and where there are four men now it will be possible to continue with three. Make a careful study of the hostlers' duties and the time when their services are required to prepare outgoing engines and meet arriving engines. Frequently you can dispense with the services of one man by changing the hours of another. If you work four hostlers you can get along with three, or if not all of the time, during certain seasons. Coal chute, sand house and cinder pit men can be worked in one group at a majority of medium size engine terminals, thus reducing the cost of handling coal, and enginehouse expenses.

The sub-foremen should be constantly on the lookout for irregularities and keep the general enginehouse foreman in touch with them in order to make this department as efficient as possible. The foreman who puts forth his best efforts and works along these lines will not be forgotten when there is a chance for promotion. Such men do not need any advertising; even officers who have never seen them know their names. The transportation department is now paying more attention to getting engines from the trains to the enginehouse than they did a few years ago, but the matter should not be lost sight of, and hostlers should be impressed with the importance of the quick moving of engines to and from trains. The most important reasons for this are that the engine crews are being paid large sums of money every month for overtime; the engine is fired up and burning unnecessary coal which is one of the biggest items of expenses the railroad has; the engine is kept away from the enginehouse where perhaps every minute of its lay-over time is needed for inspection and repairs, and in a great many cases some high-priced mechanic is idle waiting for the hostler to move an engine for him, in order that he may put in a rod pin or some other part.

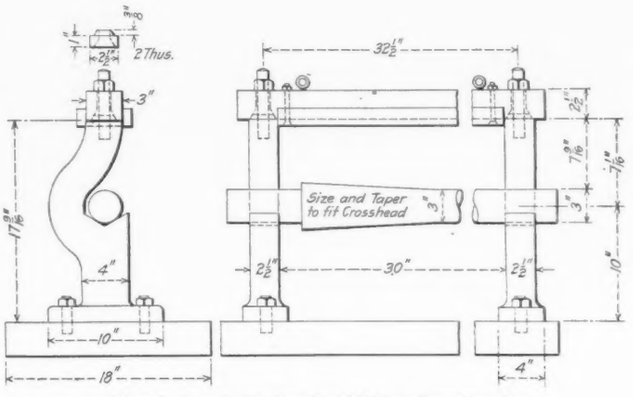
As soon as the engine arrives at the terminal and the fire is either banked or knocked out, the tubes should be cleaned. This should be done when the engine is warm. Cleaning tubes and washing boilers are very closely connected; each affects the coal pile if not properly done, and it will be found advantageous to work the men doing this work in groups and require the boiler foreman and shop foreman to personally follow up this work and see that it is properly done.

It is important to watch the orders from the transportation department. If engines are ordered and fired up and then not used, a report should be made to the proper officers. Thousands of tons of coal have been wasted due to engines being ordered and then the order cancelled. For the protection of the enginehouse force, three hours' time should be required to prepare an engine when it is ordered for a run not shown on the schedule. The order should be in writing, and, if taken over the telephone, it should be confirmed in writing.

BABBITTING CROSSHEADS

BY H. C. GILLESPIE
Master Mechanic, Chesapeake & Ohio, Peru, Indiana

The accompanying drawing shows a jig which is used to babbitt the guide bearings of crossheads. It consists of a frame to the top of which is attached a crossbar and in the ends of which are provided V-bearings for the ends of the mandrel on which the crosshead is mounted. This is provided with a taper fit, the taper being the same as that of the crossheads, which facilitates mounting the latter and makes it only necessary to square the crossheads with the



Mandrel and Jig for Babbitting Crossheads

base of the jig after the mandrel has been placed on its bearings. To the crossbar is attached a shoe which has been planed to the proper size for the guides of the engine class on which the work is being done. The height of the crossbar may be varied as required. By the use of this jig a crosshead can be finished ready for the engine in about one hour. It is ready for application as soon as the babbitting is done, no machine work being required.

PREVENTION OF BOILER CORROSION BY ELECTRICITY

The method of preventing boiler corrosion, known as the Cumberland system, is being tried by the British Admiralty. This system is based on the electrolytic theory of corrosion and makes use of suitable iron plates placed within the boiler and insulated from it. These plates are connected to the positive terminal of a low tension generator, the boiler shell itself forming the negative terminal. The corrosion and pitting caused by local differences of potential between various points on the interior surfaces of the boiler is transferred to the anode plates by introducing a superior electro-motive force from an external source which insures that the flow of current is always from the inserted electrodes to the surfaces of the boiler. A potential of from six to ten volts is required and the current used is about one ampere for each 500 sq. ft. of surface to be protected. It will be seen that the action is similar to that of zinc placed within the boiler, but the iron anodes, used with an external source of current, do not require the frequent renewal which usually makes the use of zinc impractical.

A Glasgow Forfeit.—In a specification recently issued for a 6,000 k.w. turbine by the Glasgow Corporation, the following clause was inserted: "Should the contractor fail to meet the guaranteed steam consumption, the contractor shall pay to the corporation the sum of £750 for every quarter of a pound or part of a quarter of a pound consumed over and above the figure of guaranteed steam consumption per kilowatt-hour."—*Power.*

THE MASTER BLACKSMITHS' CONVENTION

A Report of the Twenty-third Annual Meeting of the Association, Held in Chicago, August 15-17



THE twenty-third annual convention of the International Railroad Master Blacksmiths' Association was held at the Hotel Sherman, Chicago, Ill., August 15 to 17, 1916, T. E. Williams, of the Wabash Railroad, presiding. The meeting was opened with prayer by Reverend De Lacey, and the association was welcomed to the city by a representative of the mayor. Mr. Williams, in his presidential address, called attention to the desirability of all the members participating freely in the discussions and telling fully of their experiences in the various subjects discussed in order that the members of the association may profit to the fullest extent by the convention. W. J. Tollerton, general mechanical superintendent of the Chicago, Rock Island & Pacific, made an address of welcome.

ADDRESS OF MR. TOLLERTON

Associations, such as the Railroad Master Blacksmiths', are of the utmost importance. Upon you, gentlemen, falls the burden of advancing our knowledge concerning improved methods of blacksmith shop practice. By means of your various committee investigations and the discussions of the reports in conventions you, as members of this association, may interchange ideas with the privilege of choosing therefrom those which will tend toward a constantly increasing economy and efficiency in railroad operation. The blacksmith's art is probably the oldest metal working craft in existence, but during the long years of its practice very little real progress was made until about 60 years ago. One might truthfully say that the modern blacksmith shop came into existence with the invention of the steam hammer. Since then a wonderful advance has been made, until now we have forging machines capable of producing accurate and intricate forgings in a few minutes that formerly would have required hours of hard labor. I believe that the development of the forging machine and the perfection of machine made forgings is the line of future progress for the modern blacksmith. A very essential part of your work as an association consists in the interchange and publication of machine forging methods now in successful use on the many railway systems with which you are connected.

While reading the committee reports and various papers presented at past conventions the thought occurred to me that it would be of enormous benefit to all railroads if this association would formulate some kind of a standardized schedule of blacksmith shop practice. As an example of what I mean, let us consider the process of case-hardening; with all the information we have on this subject, would it not be possible to arrive at some conclusion as to the exact procedure to be followed to give a case-hardened product of maximum value in railroad service? At the present time a great many methods are used. Different types of furnaces are used with a great variety of carbonizing mixtures and case-hardening temperatures are far from being fixed. Would it not be of great advantage to crystallize the opinion and experience of the members of this organization so as to arrive at a more definite and precise method of procedure, not only in connection with the matter of case-hardening, but all other methods of smith work that are under the direct jurisdiction of the members?

The present convention is assembled at a very serious period, and at a time when the need for economical methods and the conservation of material is more pronounced than at any other time in the history of this association. One of the most promising avenues for saving now open to the railroads is in the scrap dock. By means of the oxy-acetylene and electric welding processes the blacksmith is enabled to weld and repair a great many parts which he formerly was obliged to scrap. In the reclamation of material considerable study and the use of considerable judgment is of prime importance in determining to what extent we should go in replacing old material in service. The fact should not be lost sight of that many locomotive and car parts fail because they were not properly designed in the first place. It would be poor economy to reclaim such parts unless they could be reinforced or a change effected in the design, such that the original defect will be overcome. In all of this work an accurate determination of costs is of first importance, and this association will agree, I think, that cost-keeping methods in the average railroad blacksmith shop are open to improvement.

TUBE WELDING

George Massar, of the Cincinnati, New Orleans & Texas Pacific, presented a paper on this subject, in part, as follows:

With the high pressures of steam which are now commonly

carried in the locomotive boiler, it is essential to provide good welds when safe ending boiler tubes. In the first place, the tube end and the safe end should be properly prepared. Second, a good furnace should be provided which will heat the tubes quickly and evenly, and, third, a good welding machine should be used and placed conveniently near the furnace. It is generally conceded that lap welds are stronger than butt welds. It is much easier to work a lap weld and to keep the tube straight. Also there is not the same danger with the lap weld that there would be in the butt weld if the weld should let go or pull apart. With the lap weld there would only be a small leak, for the lap would still hold the body of the tube in place, but when a butt weld fails, the body of the tube drops down and leaves the full area of the tube exposed, which is almost sure to cause serious injury.

Close attention should be paid to the proper scarfing of both the safe end and the tube end. A sharp short lap of from ½ in. to ⅝ in. is advisable on small tubes. When the joint is prepared in this way the place at which the weld is made will not be much thicker than the gage of the tube and it will heat evenly. Where the tubes are not scarfed there is a double thickness of metal to heat, and there is a tendency to overheat and burn the tube just back of the joint, particularly with steel tubes. There should be a proper plan adopted for scarfing the tubes and the safe ends so that the metal of the body of the tubes and the safe ends fit closely together. Care should be taken to keep the heating port in the oil furnaces, which are now commonly used for tube welding, narrow so as to concentrate the heat on the weld. If this is neglected and the opening is too broad the safe end will be overheated on the tube sheet end where it has to stand the rolling, beading and prossering. The mandrals on the welding machine should be kept well up to size. On small locomotive tubes the welding and swedging should be done at the same heat and thus eliminate the cost of a reheating.



T. E. Williams, President, Master Blacksmiths' Association

All superheater flues should be welded at one heat. It is a very simple matter to do this by getting the proper heat on the flue, which can be done by watching the heat inside of the flue. The bumper should be removed from the back of the furnace, and the heater stand at the back and hold the safe end in place with tongs until it shows signs of the welding heat. The safe end should then be given a few light taps with a hand bumper until it is well set in the flue. When the metal on the inside shows that it has been heated to the proper temperature the flue with the safe end should be placed in the welding machine and welded.

Good heating is the most important part of tube welding. No matter how well a tube is scarfed and prepared, or what type of welding machine is used, or in how perfect a condition the welding machine is kept, results cannot be obtained unless the metal is properly heated. Overheating of the metal causes more accidents than underheating, for in the first case it will break off abruptly and allow the tube to drop, giving a full opening for the escaping water and steam.

L. R. Porter of the Illinois Central also presented a report on this subject, stating in part, as follows: The flue welding work on the Illinois Central is done by the boiler shop forces. The tubes are trucked from the erecting to the boiler shop, where they are run through an Otto rotary machine and then passed to the cutting machine. One man handles the two machines. He cuts off one tube while the other is cleaning. One man applies the safe ends, sticking them on, welding them and swedging them, averaging about 22 tubes per hour. The tube is swedged and welded with a Draper pneumatic hammer. The superheater flues are swedged in the smithshop under a Beaudry No. 7 power hammer. In this hammer dies are used, but no mandrel of any kind. The work is done with very good success. Two men will swedge 12 tubes per hour and carry them in and out of the shops, as the room is limited and they cannot be piled inside.

FRAME MAKING AND REPAIRING

G. A. Hartline of the New York Central West presented a paper on this subject, from which the following is taken: The portable system of repairing locomotive frames in position on engines has largely solved the problem of doing this class of work in roundhouses or machine shops where no other facilities are at hand. One of the most essential features in making the different kinds of welds is to have a clean surface at the point where the weld is made. Great care should be taken to avoid all strain in cooling, as the frame is liable to break in some other location. In our shop we use the oil furnace and the electric processes of welding. Fig. 1 shows an oil weld made on a passenger engine. The upper and lower rails were welded at the same time. Enough of the fracture was cut away to leave both ends square. A block was finished all around on the inside to make a good fit between the rails of the frame. After the frame had been jacked apart three-quarters of an inch the block was inserted and caulked with an air hammer all around to keep out any dirt or scale that might accumulate at this point. A brick furnace was built around the frame with a two-inch clearance. The burners were located on either side of the frame and the frame brought to a welding heat. A few of the bricks were then removed and the frames rammed on both sides, after which the bricks were replaced and the frame allowed to cool off. This frame was welded the latter part of December, 1914, and is still in service.

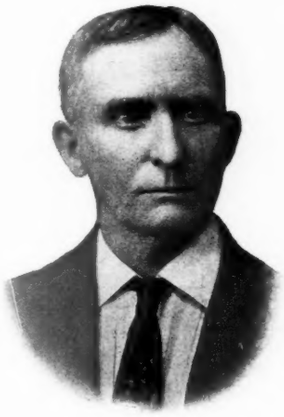
Fig. 2 shows the method of welding a locomotive frame by the electric process. The fracture was cut away to an angle of 45 deg., and the opening filled in to the full size of the frame. It was then reinforced, as shown in the illustration, with strips of ⅝-in. round cold-rolled steel on the bottom and sides, this steel being welded into place directly over the crack. The top and inside of the frame could not be treated in this manner on account of a heavy cross brace that was located at this point.

The following is from a paper on this subject by P. T. Lavender of the Norfolk & Western: In making or repairing locomotive frames the first essential is having the necessary facilities to handle the heavy frames which are constantly increasing in weight. The blacksmith should have at all times sufficient experienced help so that the job can be properly and quickly done. Welding frames with Thermit, oil or by the electric process, has proved satisfactory where the repairs to be made are of a light nature and when the engine is being rushed back into service. In repairing with the elec-

tric process the frames are prepared in a manner similar to that used when they are welded on the anvil. The break is V-ed out with an oxy-acetylene torch and then welded up by the electric process. When an engine comes in for heavy repairs and the frames are in bad condition they are brought to the smithshop and welded on the fire.

DISCUSSION

The discussion of this subject was quite extended, and those who came from shops at which either the electric or oxy-acetylene methods were extensively used reported that excellent results had been obtained by both these processes. It was pointed out, however, that expert men must be chosen to do the work. On the Frisco it was stated that the oxy-acetylene welded frame is a greater success than a frame weld made by any other method. Three-sixteenths of an inch is allowed for expansion, and the work is done in one heat; that is, the weld is not allowed to cool from the time it is first started. Two men work on the frame at the same time, one on either side. If the job is a long one they are relieved by two others, who are ready at all times to pick up the work without allowing the frame to cool. J. Grimes stated that on the New York Central, of over 300 welds made by the electric welding process only four per cent were failures. The breaks in the frames were V-ed out and welded, the section being increased in size.



W. C. Scofield, Vice-Pres., Master Blacksmiths' Association

The manner in which the frames were cast was also spoken of. H. D. Wright, of the Big Four, called attention to the fact that the thicker portions of the frame were found to fail many times sooner than the section of lesser cross section. He believed that this was due to the fact that as the frame was cast the smaller section cooling first created strains on the thicker section, decreasing the density of metal in that locality and causing weak spots. He stated that this could be obviated by placing risers at the heavy portions when the castings were made and adding more metal to these risers as the shrinkage of the smaller section pulls the metal away from the thicker section. Where this was done it has been found that the frames do not break as readily as where it is not done. It was also pointed out that sharp corners had many times been found to be responsible for cracks occurring in the frames.

John Carruthers, of the Duluth, Missabe & Northern, also called attention to the severe strains set up in pedestal jaws when the shoes and wedges were not kept up in proper condition and when the rods were allowed to pound. Poor track is a very active source in causing frame breakages. He suggested that a committee be appointed to report at the next convention on the best practice of welding locomotive frames, in accordance with the ideas suggested by Mr. Tollerton in his address.

Repairing the frames on the locomotives in preference to taking them to the smithshop and making an ordinary smith fire weld was believed by Mr. Grimes, of the New York Central, to be the most practical way. In the shops at Cleveland the welds are made on the engine in preference to making them in the smithshop. This is carried to the extent of placing new front end sections on frames with the frames on the engines. T. E. Williams explained the methods being used by the Wabash Railroad, of welding frames which had cracked in the upper rail at the corner of the pedestal jaw. The break is V-ed out and two wedges, machined to fit in the V's, are bolted to the break and welded by the oil torch method, one torch being on either side of the engine.

DROP FORGING

H. E. Gamble, of the Pennsylvania Railroad, presented a paper on this subject, in part, as follows: In drop forge work, if the dies and trimmers do not have the proper treatment and are not made from good steel they will not last. Carelessness in making them will cause many delays and also much expense. It is also bad practice to overtax any hammer. The expense in replacing rods, dies and anvil blocks would more than pay for the purchase of a hammer of larger capacity. In the Juniata shops of the Pennsylvania Railroad, the Chambersburg, the Erie and the Morgan hammers are used. The steels used for the dies are Colonial, Carpenter, Sanderson, Vanadium cast-steel, Hardtem, Chrome Vanadium (*S* grade), Park alloy, Mayari, Adamite and 45-point carbon well hammered bloom steel. For hot trimming we use axle steel, bloom steel, crescent hot work No. 2 Peerless *A*, Firth-Sterling, Colonial and Sanderson No. 3 to 3½ temper. We make out of the scrap iron or steel all of the large forgings that can possibly be made. The extra cost for roughing dies and preparing the metal for the forming dies should be carefully considered, as it all means time and money and also reduces the output of the hammer.

The first question to arise when the dies or trimmers are being designed is how much strength is required to withstand the working conditions. That material should be used, the grade and carbon content of which will admit of its being treated so that the longest wearing surface can be obtained in conjunction with sufficient strength to resist the working conditions. We must have a sufficient working knowledge of the critical points of the steel or the nature of the mineralogical changes in the steel when it is heated in order properly to prepare the dies and trimmers. Keep the tools and furnaces up in good condition, as the time spent in fooling around with an old tumble-down furnace will cost more than if money were spent for a good furnace.



J. Carruthers, Vice-Pres., Master Blacksmiths' Association

Good steel for dies may be found in the following three brands: Sterling, Mayari and Hardtem. This material is forged in suitable blocks for drop forge work and is a special alloy steel treated before leaving the mill, so that it is not necessary to harden it. After the impression is worn out it is not necessary to anneal this steel; simply plane and resink the die and it is ready for use. A good steel for piston rods is the Heppenstall, which is treated at the mill and delivered rough-turned. This gives excellent service.

Unless everything connected with the drop hammer is properly handled by the operator you are bound to have broken dies and piston rods. Sediment under the section blocks and dies not properly treated and keyed up will give bad results. Make the tongue on the dies of good width to insure a good bear-

ing on the section block, it saves liners and keys. Always have the guides adjusted and oiled regularly. The operator must examine the many parts of the drop hammer regularly. It will be found that a regular and systematic examination will overcome many an accident. Use plenty of lubricant when necessary, in order to insure good service.

TOOLS AND FORMERS

George Fraser, of the Atchison, Topeka & Santa Fe, presented a paper on this subject, in part, as follows: There is no place about a railroad shop where such a saving can be made, provided the shop has good tool equipment, as in the blacksmith shop. Good shop organization and a first-class supply of good tools of all kinds are necessary to increase the output and reduce the cost in the smithshop. In the Topeka shops we have about 1,500 dies and formers of all kinds. Fig. 3 shows the dies used for forming the ends of spring hangers on a 4-in. forging machine and at the same time producing a fillet at *A* without checks, flaws or scarfs. The back stop is set so that the edge *B* on the boss of the hanger is 1 in. from *C* in the dies. The back stop has a spring block, as shown in the illustration, which is forced closed as the header forms the end of the hanger. The header is provided with a groove 3/16 in. wide and ⅛ in. deep to overcome the seam in the center of the boss.

Fig. 4 shows a method of reclaiming car axles. The scrapped 5-in. by 9-in. axles are made over into 4¼-in. by 8-in. axles, the 4¼-in. by 8-in. into 3¾-in. by 7-in., etc., by the following method: The axle is heated and is made to the correct length at *A*. At the same time the collar on the end of the axle is swedged down to the size of the journal. The axle is then annealed. The ends are heated and forged in a forging machine the dies for which are shown in Fig. 4. The dimensions *A A* of the dies are ⅛ in. larger than the axle, the dimension *B* is 1 in. shorter than the finished length, *C* is ½ in. larger, *D* is ¼ in. larger, and *E* is ¼ in. shorter than the finished sizes to allow for machining. The plunger upsets the end of the axles and centers them at the same time. Up to the present time over 5,000 axles have been thus reclaimed on the Santa Fe system.

SPRING MAKING AND REPAIRING



A. L. Woodworth, Sec.-Treas., Master Blacksmiths' Association

The following is from a paper by W. C. Scofield, of the Illinois Central, on this subject: Many roads are discontinuing tapering the ends of the spring leaves as an unnecessary expense, but it does not make as nice a looking spring. It is the practice on the Illinois Central to fit and cool the springs in an oil bath at the same heat. The open hearth spring steel over 5/16 in. thick is not flashed, but left as it comes from the oil. It is very important that the heat in a fitter's furnace be regulated properly and easily controlled, as a uniform heat is absolutely essential in making good springs. The best method of fitting is to use a machine that sets each leaf to leaf by air or hydraulic pressure and one which operates quickly. The steel must be be of uniform grade and quality, as it is self-evident that where different kinds of steel are used in the same spring, all being heated and treated the same, the spring will not give the proper results. In repairing springs, if the leaves are not broken or worn too much and are of the proper set, they are not overheated or refitted, but are placed in the spring as required. Vanadium steel springs are being used by many roads, which report excellent results.

DISCUSSION

Some of the members have found difficulty in repairing the springs on account of not being furnished with the same material from which the original springs were made. This was generally conceded to be very bad practice. Numerous instances were mentioned where the original springs had not been found to be of sufficient capacity, and it was believed advisable for the blacksmith to be sufficiently familiar with the weights of the engines for which they are called upon to repair springs, in order that they may determine for their own satisfaction whether or not the springs were too light for the service in which they were used, and in this way protect themselves from criticism of their work.



George P. White, Asst. Sec.-Treas., Master Blacksmiths' Association

It was believed to be poor practice to use the broken leaves for the leaves of shorter length, and on some roads the leaves are scrapped after they have been reset four times. A number of the roads are not tapering the ends of the spring leaves, believing this to be a waste of time and money. It was also believed by a large number that it was not necessary to cool the bands when they were put on at a dark red heat as this heat would not draw the temper enough to do any harm, whereas if the bands are dipped the leaves are apt to become too hard. J. W. Riley, of the Lehigh Valley, contributed a layout of the spring plant of that road at the Sayre, Pa., shops, which is shown in Fig. 5.

CARBON AND HIGH-SPEED STEEL

George W. Kelly, of the Central Railroad of New Jersey, presented a paper on this subject, in part, as follows: The forging of carbon steel always requires skilled workmen, especially for the larger tools, such as taps, reamers, etc. Carbon steel should be hardened at the lowest possible heat, and always on a rising heat. Steel may be forged at a higher heat than the hardening heat, but should, in all cases where a large or expensive tool is being forged, be annealed before being heated for hardening. We are welding tips on tire steel for all lathe tools by the electric welding process and obtaining very good results. When the 6-in. by 10-in. special milling cutters are worn down they are box annealed, recut and hardened, as follows: They are first preheated in an oil furnace up to 1,400 deg. F. They are then passed to a specially prepared hollow fire and heated to 2,000 deg. F. The cutting edges are protected by powdered borax. The cutter is then dipped into a cask of melted lead. Running water is allowed to circulate around this cask. When the lead is set it is reheated and the tool taken out and cooled in oil. The tire-forming tools are hardened in the same manner. It has been found that this gives very good service with no breakage.

J. J. Conners, of the Atlanta & West Point, also presented a paper on this subject, of which the following is an extract: During the past two years we have been welding high-speed steel on axle steel shanks by the oxy-acetylene method, and

in this way use up the small pieces of high-speed steel tools. In annealing the high-speed steel it is heated to a red heat and placed in an iron box or pipe and covered with pulverized charcoal, put in the furnace over night and removed the next morning, but the box is not opened until it is thoroughly cooled. In hardening the high-speed steel lathe and planer tools, they are heated to a high heat sufficient to just about burn the point of the tool and are then cooled in a fan blast.

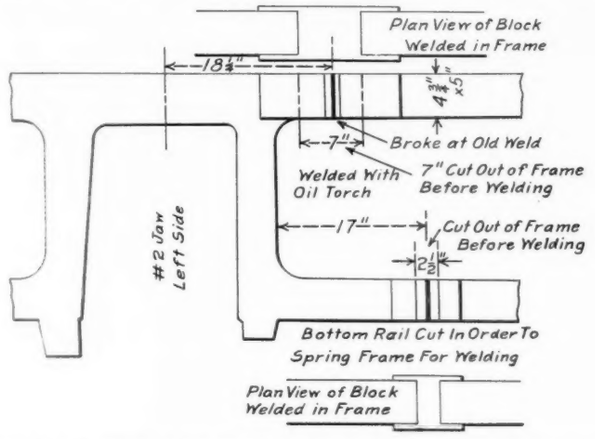


Fig. 1—Location of Oil Weld on Frame of Passenger Locomotive

The taps or reamers made of high-speed steel are hardened in oil.

D. M. Dulin, of the Norfolk & Western, also presented a paper, in part, as follows: We have been welding high-speed steel tips on carbon steel shanks by the electric butt welding process. The tools to be welded have the surfaces ground bright and are clamped in the vise, and the current applied. A vise screw is operated to press the two metals together as the temperature increases. The power required to

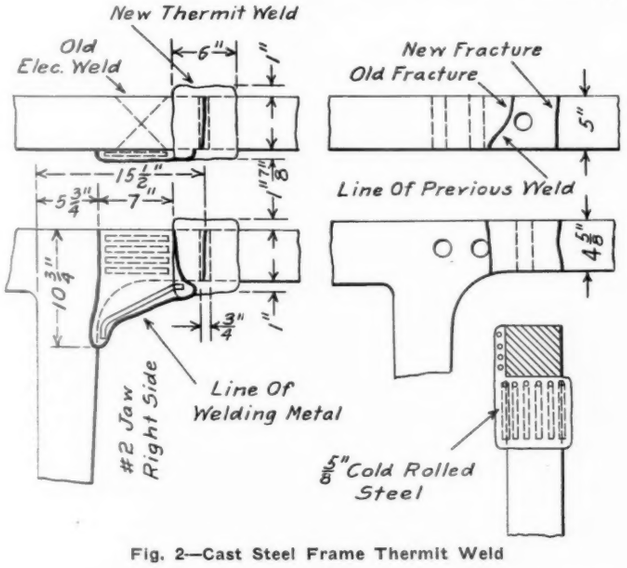


Fig. 2—Cast Steel Frame Thermit Weld

operate the machine is from ½ to 5 volts, and 8,000 to 16,000 amperes. We weld tools from the smallest size up to 2 in. by 3 in., with good success. The tools are dressed after welding and are hardened in an air blast or oil, as preferred.

DISCUSSION

George W. Grady, of the Chicago & North Western, stated that at the Chicago shops of that road high-speed steel tips have been welded on tire steel shanks by the oxy-acetylene method, tire steel being used for the metal to fill in between the high-speed steel tip and the shanks. It has been found possible to forge these tools to any desired shape, and to redress them until the high-speed steel has been entirely worn off. The tire turning tools have met with very good success, one tool having turned 214 tires.

Several members stated that while they had found it possible to weld high-speed steel on tire steel shanks, it had been found impossible to forge the tools for the tips would invariably come off. In many cases it was only possible to redress the tools once, and then but a few blows of the hammer must be used. Mr. Harris, of the Missouri, Kansas & Texas, Parsons, Kan., stated that high-speed steel tips are welded on carbon steel shanks, as follows: The shanks are heated and the flux compound applied. The cold tip is then placed on the shank and the whole reheated. The tool is then formed in a forging machine.

There was considerable discussion in regard to annealing high-speed steel, some claiming that the use of charcoal in this process would injure the steel. However, it was pointed out that if the steel was properly protected from the air no trouble would be experienced with properly annealing this

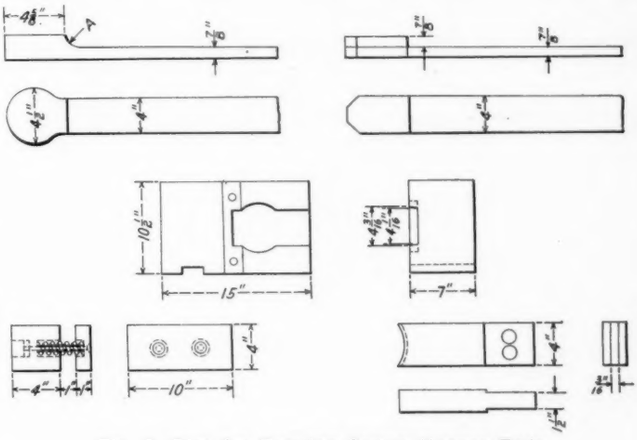


Fig. 3—Dies for Forming Spring Hanger Ends

grade of steel, regardless of the kind of packing material used.

FROGS AND CROSSINGS

George T. White, of the Missouri, Kansas & Texas, presented a paper on this subject, saying, in part, as follows: At the Parson shops of the Missouri, Kansas & Texas we manufacture 150 rigid frogs per month, and repair 30 spring frogs per month, in addition to other various items, such as guard rails and reinforced switch points. In making repairs to frogs and switches our Oxweld plant plays a very important part. We have several switch points which were built up by the Oxweld system that have been in service six or eight months and are good for several months to come. This is about the length of service we get from most new points on this line. This road also operates a repair car fully equipped for making light repairs to frogs and crossings on the road. Three men, who accompany the car, make the light repairs wherever they may be necessary, and where they can be made without removing the frog from the track. This car is sent over the entire road. The road's repair gang keeps the shops at Parsons advised as to when the frogs will need to be replaced. This gives the shops time to build the frogs for any given place.

D. Huskey also read a paper describing briefly the new frog and switch plant of the Chicago Great Western at Oelwein, Iowa.

DISCUSSION.

Mr. White stated further that repairs to a switch point by the Oxweld method cost an average of $1.25 each, and re-

pairs to a spring frog cost an average of $2. Some, however, will run as high as $4 or $5. It has been found on the Missouri, Kansas & Texas that this class of repairs will give practically the same life as a new point. However, it was stated that the Frisco did not find this to be the case. On that road it is the practice to raise the point by splitting the web and then fill in the web by the Oxweld method, thus using the original material on the point. The use of manganese rail for all frogs and crossings was strongly recommended.

PIECE WORK

H. D. Wright, of the Cleveland, Cincinnati, Chicago & St. Louis, presented a paper on this subject, in part, as follows: A proper piece work system is one that will be beneficial for both the company and the employee, but there must be some well-defined system of making the prices, checking the work and figuring the cost so as to divide the money justly. Piece work will develop the mechanic and will eliminate the sluggard. It brings out the best the mechanic has in him, for he knows that he will be paid for the results of his efforts, and he will not hesitate to show his ability. In gangs it has

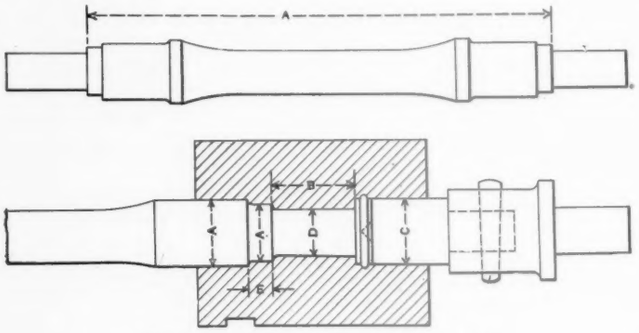


Fig. 4—Dies for Reclaiming Car Axles

a very beneficial effect. The men will work together with much more team work and they will turn out a larger amount of work.

First-class mechanics should be chosen for piece work inspectors. They should be thoroughly competent to make a price that will be just and also be able to show the men how the work can be done under the price set so that they will be able to make a profit. Where piece work is used the foremen must study their men and see that they are placed on the class of work to which they are best adapted. This will not only benefit the company, but the men as well. Conditions will vary in different shops, and it is hard to give much detailed instruction regarding the application of piece work on this account.

RECLAMATION OF SCRAP

J. Harkins, of the Southern Pacific, presented a paper on this subject, from which the following is taken: There is no department in connection with a railroad that should be given more attention than the reclaiming department. This is particularly true at the present time when all classes of material used in railway equipment have advanced in price from 10 to 50 per cent, and in some cases even more. The following is a list of tools used in a reclaiming plant, one or more being used according to the amount of work being done: Oil forge, oil furnace, steam hammer, power hammer, shears, bulldozer, power punches, forging machine, straightening press, nut tapping and bolt threading machine.

The following are a few of the many articles being reclaimed at the Southern Pacific shops at Sacramento in which large savings have been made for the company: Handholds, king pins, coupler pins, coupler yokes, coupler plates, carry-irons, brake rods of all kinds, brakeheads, brakeshoe keys, brake levers, brake staffs, brake staff hand wheels and brackets, uncoupling levers, door clamps, door straps and fulcrums, turnbuckles, running board brackets, brakebeams, sill steps, old bolts, nuts, washers, etc. We also reclaim all track material that can be made serviceable, such as frogs, crossings, switch points, connecting rods, track picks, tamping bars, claw bars, chisels, wrenches, mauls, gages, lining bars, etc.

There are also many articles that can be made from scrap and obsolete material as a substitute for new material. Old boiler tubes when flattened can be used for making car door plates, washers, split keys, pipe hanger clamps, angle irons, etc. Coil springs of various sizes, after having been straightened, are used for making lining bars, drift pins, etc., and can also be rolled into smaller sizes and used for making new springs. Thirty-ton car axles are made from scrap 40-ton axles, and 40-ton are made from 50-ton axles, this being

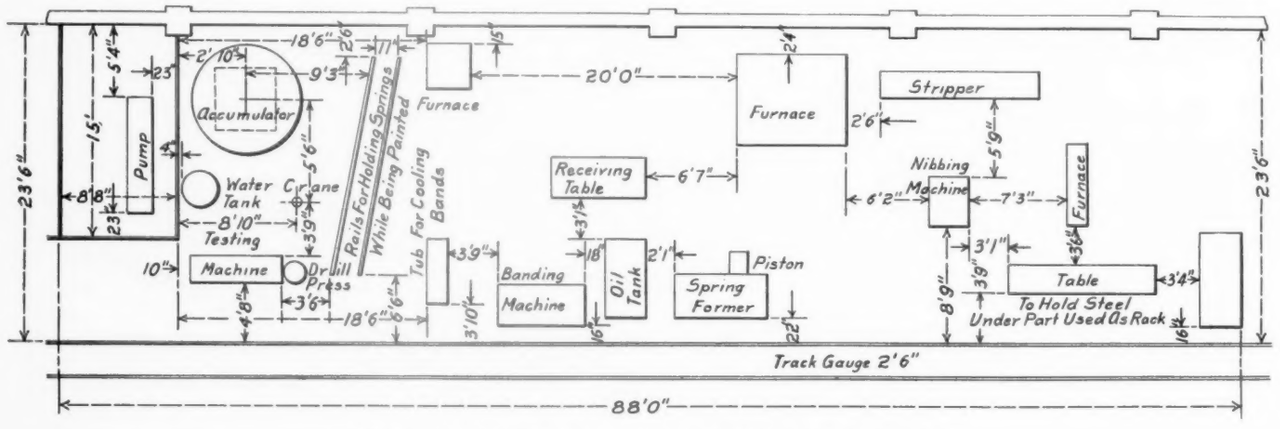


FIG. 5—Plan of the Spring Plant of the Lehigh Valley at Sayre, Pa.

Scrap tire steel can also be used for making standard track claw bars, pick points, tamping bar ends, headers and dies for bolt forging machines and shanks for lathe and planer tools of various sizes. These tire steel shanks with high-speed steel tips are giving very good service. At our shops we endeavor to reclaim all serviceable material. The remainder is sheared to length and turned over to the rolling mill, where it is rerolled into all standard sizes of bar iron. This iron is then shipped to outside points on the line. The average monthly reclamation in this mill is about 4,350,750 lb.

J. H. Daltry, of the Erie, also presented a paper on this subject, of which the following is a part: Lathe tools are made out of scrap tires with high-speed steel tips welded on by the electric process at a cost of about 10 cents per tool. They are giving very good results. Worn coupler knuckles are reclaimed by welding on a piece of 3/8 in. by 2 in. iron where the knuckle is worn. The cost of labor for this is 15 cents a piece for all classes of knuckles and about one pound of wrought iron is used. The reclaimed knuckle is practically as good as new. The side ladders on box cars are made from scrap boiler tubes flattened out under the steam hammer, for which $1 per 100 is paid. This is used in place of the 3/8 in. by 2 in. iron which is generally used for this purpose. Tube beading tools are also made out of tire steel and are doing the work just as well as those tools made from tool steel. All the hexagon-headed bolts removed from locomotives when undergoing repairs are annealed and turned down to a smaller size and used again. All of the blacksmith tools, except chisels, are made from scrap tire steel. Boiler and machinist hand tools are made of scrap coil springs and are giving very good results.

TOPICAL DISCUSSIONS

Oxy-Acetylene and Electric Welding.—It was believed to be the best practice to have all welding, whether done by either the oxy-acetylene or electric welding process, under the jurisdiction of the blacksmith. This plan is followed on the Frisco. On that road a blacksmith is the foreman of the welders, no matter what class of work is being done. It has been found that a blacksmith, in view of his experience in the heating of metals, is better able to make the proper allowance for shrinkage than any other craftsman. On this road the Oxweld system is used very extensively for reclaiming and repairing a large assortment of material.

A method followed in welding frames was described by one member as follows: The frame each side of the break is covered with an asbestos plaster in order to prevent undue heating of the frame on either side of the break. A fire brick is laid across the top of the plaster above the break to concentrate the heat in the weld. An air jet from a vertical pipe about 3 ft. long, perforated with 3/16 in. holes, is so located as to blow the heat away from the operators as much as possible. The frame is not pre-heated before welding, and during the process of welding the metal fused into the break is frequently hammered with an air hammer.

Case-Hardening.—The hydro-carbonate of bone black seems to produce the best results in case-hardening. For quick work a mixture of 14 lb. of potash to 50 lb. of salt, melted in a crucible and brought up to a temperature of 1,800 deg., was strongly recommended. However, the price of potash is so great at the present time that this method is almost too expensive to be considered. Questions were asked regarding methods by which the case hardening could be done in a short period of time, but it was generally believed that if any material is to be case-hardened to the proper thickness it must be given sufficient time and that no short-cut methods were available. Material can, however, be case-hardened in a minimum amount of time if the material is placed in the furnace in small quantities, as it will take less time to bring the material up to the proper temperature. Some questioned the advisability of carrying the case-hardening deeper than 1/16 in., but it was pointed out that if it was only carried this deep the outer surface would not be as hard nor contain as large an amount of carbon as if the case-hardening was allowed to penetrate to 1/8 in. With the 1/8 in. case-hardening the material would give much better service and wear for a longer time. The question was also raised as to whether or not the inside of the case-hardening box was not hotter than the furnace itself. It was explained that that would be dependent on the material used for doing the case-hardening. Pure charcoal would undoubtedly show higher temperatures inside the case-hardening box than the furnace would show. However, if the material was of an inert nature the temperature would not rise.

Heat Treatment of Metals.—H. E. Gamble, of the Pennsylvania Railroad, gave a brief talk on the heat-treatment of metals, referring to his rather extensive paper on the subject printed in previous proceedings. He stated that the steel should be heat-treated according to its carbon content. The steel should be analyzed before being treated to find out just what its percentage of carbon is. The smaller articles are heat-treated in oil and the larger ones in water. The success of heat-treating is dependent to a very large extent on the facilities for doing the work. In annealing rods it was stated to be bad practice to anneal one end of the rod at a time. The entire rod should be heated and annealed at once.

In replying to a question as to the adjustment of the length of a heat-treated side rod on the smith fire, Mr. Hutton, of the New York Central, stated that if the heat used in making this adjustment was at a temperature lower than that used in treating the rod the heat treatment would not be affected. On the other hand, if the heat used in adjusting the rod was greater than that used in treating it, it would be necessary to reheat-treat the entire rod. Attention was called to the articles on the heat-treating of steel in the *Raiway Mechanical Engineer* for July and August, and it was voted to have these articles reproduced in the proceedings.

OTHER BUSINESS

A paper was also read on the use of powdered coal as fuel for blacksmith shops, by C. F. Herington, mechanical engineer of the Bonnot Company, Canton, Ohio. This paper is abstracted elsewhere in this issue. The following officers were elected for the coming year: President, W. C. Scofield, foreman blacksmith, Illinois Central, Chicago, Ill.; first vice-president, John Carruthers, foreman blacksmith, Duluth, Missabe & Northern, Proctor, Minn.; second vice-president, George T. White, foreman blacksmith, Missouri, Kansas & Texas, Parsons, Kan.; secretary-treasurer, A. L. Woodworth, Lima, Ohio. The secretary reported a total membership of 237. Chicago received the largest vote for the next place of meeting.

ENGINEHOUSE ORGANIZATION*

BY C. C. LEECH

The large body of men required to successfully and efficiently operate a large enginehouse may perhaps be best managed by dividing them into four groups or divisions, each under the supervision of an assistant foreman who has been specially trained and selected for his peculiar fitness for the work to be performed by his group. The arrangement of these groups or divisions will, of course, vary somewhat with the conditions, and while the force should be amply large to meet the heaviest strain, it must not be top heavy, or include any dead wood. But it is usually found that the force is never any too large whether in busy times or slack.

The following is suggested as a practical arrangement of the groups, and has worked out satisfactorily:

Group 1.—Made up of machinists, helpers, pipe fitters and engine inspectors.

Group 2.—Made up of boiler makers and helpers, the boiler washing, boiler testing and staybolt testing gangs, staybolt inspectors, tube cleaners and firing up men.

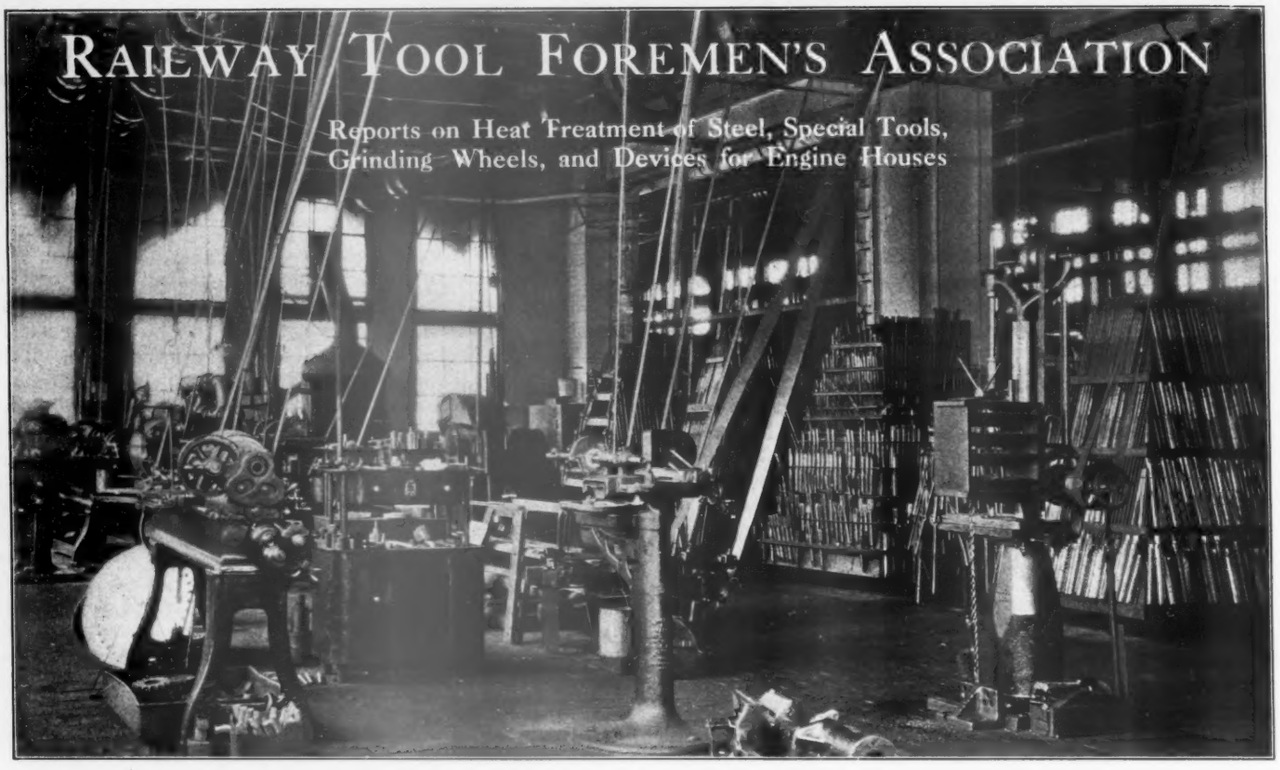
Group 3.—Made up of laborers, sweepers, house cleaning gang, and the engine wipers and cleaners.

Group 4.—Made up of the hostlers and engine caretakers, the ashpit gang, coaling men, engine despatchers, callers and the turntable men.

*Entered in the Engine Terminal Competition.

RAILWAY TOOL FOREMEN'S ASSOCIATION

Reports on Heat Treatment of Steel, Special Tools, Grinding Wheels, and Devices for Engine Houses



Tool Room of the Chicago, Great Western at Oelwein, Ia.

THE eighth annual convention of the American Railway Tool Foremen's Association was held at the Hotel Sherman, Chicago, Ill., August 24 to 26 inclusive, J. J. Sheehan, tool foreman of the Norfolk & Western, presiding. Prayer was offered by Bishop Thomas Nicholson, and the convention was welcomed to the city by John D. Shoop, superintendent of Chicago schools. J. A. Carney, superintendent of shops of the Chicago, Burlington & Quincy at Aurora, addressed the convention. President Sheehan in his address of welcome said:

You have been called from your various roads for the purpose of reviewing the progress that has attended our efforts during the past year, as will be shown by the committee reports, and to gain new ideas from them and the discussions on the floor of the convention. That our association has filled its niche in the railroad field is evidenced by the many favorable comments and references that have come to my notice. This is gratifying, inasmuch as it proves there is a need for the work in which we are engaged and it should stimulate us to put our earnest efforts into that which we undertake. The association is in a healthy condition, both financially and in regard to increased membership.

HEAT TREATMENT OF STEEL

Henry Otto, A. T. & S. F.: Whether annealing, hardening or tempering, each grade of steel has a definite temperature to which it should be heated in order that it will give the best results. This temperature will also vary according to the use to which the steel is to be put. Slight variations from this proper temperature may do irreparable damage to the steel.

Carbon Steel.—Carbon steel when not heated above 1,350 deg. will be in the annealed state and when heated to 1,350 to 1,500 deg. will be in a hardened state. When heated above 1,500 deg. it will be softer than the second case mentioned, although harder than the first. In the actual heating of a piece of steel several requirements are essential in order to obtain good hardening; first, the small projections or the cutting edges should not be heated more rapidly than is the body of the tool, and second, all parts of the tool should be heated to the same temperature. A tool heated uniformly to as low a temperature as will give the required hardness will produce the best results. As steel is heated there is a certain period during which the internal structure of the steel changes. This is called the "critical point" and will vary according to the amount of carbon contained in the steel. With the steel used at the Topeka shops of the Santa Fe for making reamers, taps, etc., this change commences at 1,280 deg. called the recalescence point and ceases at 1,385 deg. which is called the decalescence point. The decalescence point is the proper temperature for hardening and the recalescence point is the proper temperature for annealing.

We heat all the tools made of carbon steel in lead pots, the temperature of which is recorded by pyrometers and maintained at the proper degree. To prevent the hot lead from sticking to the tool heated in it, the tool is painted with a mixture of common whiting and wood alcohol. These lead melting pots are made from 6 in. iron pipe and are reinforced with ¾ in. by 4 in. iron rings, the bottom being welded in. They will last when used every day for about three or four months. All tools made of carbon steel are quenched in pure water in a tank shown in Fig. 1.

For tempering by the color method temperatures corresponding to the different colors are given below:

Color.	Deg. Fahrenheit	Color.	Deg. Fahrenheit
Very pale yellow	430	Spotted red brown	510
Light yellow	440	A brown purple	520
Pale straw yellow	450	Light purple	530
Straw yellow	460	Full purple	540
Deep straw yellow	470	Dark purple	550
Dark yellow	480	Full blue	560
Yellow brown	490	Dark blue	570
Brown yellow	500		

The modern method of tempering is to heat the tools to the required temperature in a bath of molten lead, heated

oil or other liquids. By this method it is possible to heat the work uniformly and to give a temperature close to the proper limit. At Topeka we use an electrically heated oil bath for tempering all carbon steel tools.

High Speed Steel.—Temperatures of from 1,800 to 2,200 deg. are required to harden high speed steel. The usual method of hardening or heat treating planing tools is to heat the cutting end slowly to a temperature of about 1,800 deg. and then more rapidly to 2,200 deg. or until the end is at a dazzling white heat and shows signs of melting. The point of the tool is then cooled either by plunging it in a bath of oil, such as linseed or cottonseed, or by placing the end of the tool in a blast of dry air. The exact treatment of high speed steel varies for the different kinds of steel, and it is advisable to follow closely the directions given by the steel makers. The container for the oil quenching bath is shown in the engraving, Fig. 2.

Heavy high speed tools having well supported cutting edges, such as planer or turning tools, are commonly used after hardening without tempering. If the construction of the tool is such that the cutting edges are comparatively weak they are often toughened by tempering or what is sometimes called "letting down" the hardness. A method recommended by several steel makers is to cover the steel with clean, dry sand and heat it to the required temperature, which should be shown preferably by a pyrometer. Milling cutters are heated to 400 deg., drills and reamers to 440 deg., for the largest sizes, and 460 deg. for the smaller sizes.

In annealing high speed steel the steel should be packed in an iron box or pipe of sufficient size to allow at least ½ in. of packing between the sides of the steel to be annealed and the sides of the box. It is not necessary that each piece of steel be kept separate from every other piece but it should be kept from touching the sides of the annealing box. It can be packed in powdered charcoal, fine dry lime or mica. The annealing box should be made air-tight and the whole thing heated slowly to a full red heat, about 1,475 deg. to 1,500 deg., and held at this heat from two to eight hours, depending upon the size of the pieces to be annealed. It should then be cooled slowly and not exposed to the air until cold.



J. J. Sheehan, President, Tool Foremen's Association

E. A. Greame, D. L. & W.: The United States Bureau of Standards states that skilled observers vary as much as 100 deg. in the estimation of relatively low temperatures of steel by the color method and beyond 2,200 deg. it is practically impossible to make estimations with any degree of certainty. This would clearly indicate that the color method is not an accurate means to use for the determining of temperatures of steel. Steel can more properly be heat-treated and better results obtained when pyrometers are used. The importance of having proper equipment for the heat treating of steel cannot be overestimated. It is the cheapest equipment in the long run. Most failures in the treating of tool steel have been attributed to the steel but there can be hardly any question that 90 per cent of the failures result from the lack of knowledge of the proper method of treatment.

A tool to give the proper degree of efficiency should be tempered to give the proper hardness and still have sufficient toughness for the work in which it is to be used. At the Scranton shops of the Delaware, Lackawanna & Western the scleroscope is used to determine the relative hardness of the steel. As a comparative measure of materials it is very accurate, rapid, simple and definite. It consists of a glass graduated tube with a small cylinder of steel which has a diamond point. This cylinder slides in a vertical direction in the tube and is allowed to fall upon a previously polished surface of the material to be tested. The height of the rebound of the cylinder is taken as the measure of the relative hardness. A pyrometer should be used to determine the proper heat treatment given for the steel. This instrument should be frequently tested to insure its accuracy. This can be done by testing with a standard pyrometer, or if low temperatures are used, by a standard mercury thermometer.

When rivet sets are to be hardened and a water hardening steel is used they should be dipped in the tank with shank down and running water directed into the cup of the tool. This treatment avoids the collection of hot water in the cup which would prevent the cup from properly hardening. We find that the vanadium alloy steel is most suitable for these tools.

In hardening shear blades, water hardening steel being used, the blade should be withdrawn from the bath at a temperature of about 225 deg. or just before the water ceases to boil on the surface. It should then be plunged into an oil bath. This treatment rapidly cools off the outer surface of the blade, making a very hard coating and by withdrawing it from the water before the water ceases to boil the interior of the blade will not have had time to become chilled. By placing it in the oil bath and quenching it further the interior of the blade cools slowly, leaving it very tough. The tool is then tempered in the oil bath in the usual manner.

To avoid cracking large spring dies when they are being hardened they are quenched in a tank of water and oil, the water being sufficiently deep to cover the threaded portions of the dies and the oil on top of the water covering the rest of the dies. By this treatment the threaded portion of the die is hardened while the body of the die is only toughened. The die can then be drawn by the usual method. Care should be taken, however, to give the die a constant circular movement.

All reamers and long slender tools should be heated in lead pots and quenched in the usual manner. This will tend to eliminate the scale on the surface and the warping of the tool. A mixture of two-thirds salt and one-third cyanide of potassium, heated to a red heat for one hour and allowed to cool and harden and then mixed in the lead bath, is a good method to prevent the lead from sticking to the threads and small projections of the tool. The top of the lead pot should be covered with bone black.

The following method is used for hardening high speed steel threading dies, taps and other delicate high speed steel tools: The tools are first packed in a cast iron box or pipe with charcoal, care being taken that none of the articles touch the side of the box. The box is then covered and heated to from 1,950 to 2,050 deg. for from two-and-a-half to three hours, according to the size of the box. The box is then allowed to remain in the furnace. On opening the box the dies are removed individually and quenched in oil. All high

speed steel tools not hardened by the pack method should first be preheated to about 1,500 deg. and then placed in a furnace of higher temperature and brought up to the desired heat. The benefit derived from this treatment is that a more lasting cutting edge is obtained due to the fact that the surface of the tool has not been exposed to a high heat for any material length of time. We have found that vanadium steels are best suited for concussion tools. In carbon and vanadium steels a higher temperature than is used for hardening should be used for annealing. In most high speed steels 1,500 deg. F. is about the proper heat for annealing. On bringing the tools up to this temperature the furnace should be sealed, the heat turned off and the furnace allowed to cool gradually, and the contents should not be withdrawn until they are cold.



C. A. Shaffer, 1st Vice-Pres., Tool Foremen's Association

Owen D. Kinsey, formerly of the Illinois Central: To obtain maximum efficiency of tool steels the treatment of them must be scientifically handled. The skill of the most experienced operator is inadequate to obtain correct hardening and drawing temperature by observation. The material and labor entering into the manufacture of tools presents an enormous annual expense to every railway system. The high priced steels improperly heat treated increase the cost of manufacture, to say nothing of the delays in production in the shops on account of not properly serving their purpose. Without the use of a pyrometer in the heat treatment of high speed steel there is considerable danger in burning away the cutting edges or warping the tool out of shape.



J. C. Bevelle, 2nd Vice-Pres., Tool Foremen's Association

More than likely the tool will not be brought up to the proper temperature for fear of overheating it, which will cause the workman considerable trouble when it gets to the shop. Then, again, the tool may break on account of the temper not being drawn sufficiently to relieve the strain. This is a matter that should be carefully studied as a tool properly drawn will reduce tool breakage and the chipping away of the cutting edge. A drawing temperature of 450 deg. has been found to give the best results for high speed steel reamers, taps and milling cutters, and a much higher temperature is now being recommended by several of the large steel producers for large tools such as for planers and other machines. [Mr. Kinsey also described briefly the electric furnace equipment of the Illinois Central, which is being used at their Burnside shops for treating the tools. This installation was illustrated and described in the *Railway Mechanical Engineer* for August, 1916, page 423.]

DISCUSSION

It was generally agreed that the directions supplied by the manufacturers with their different steels should be closely followed in heat treating steel. Where steels of different grades are used in a shop they should be carefully marked as they are made into tools in order that they may be given the proper heat treatment. The advantage of the lead bath over the charcoal fire was explained as being due to the uniform heating of the tool by the lead bath. In a charcoal fire drafts of air will cause the tool to warp and the oxidation will cause soft spots on the tool. Mr. Bevelle explained the method of treating rivet snaps on the El Paso & Southwestern. Steel of .75 per cent carbon is used, which is hardened at 1,475 deg. and quenched in oil. The temper is not drawn.

There was considerable discussion concerning the advisability of the railroads making their own staybolt taps. Some roads find that they do not get as good results from the home-made tap as they do from those which are purchased, while others claim that much better results can be obtained. Mr. Nelson of the Soo Line stated that that road was obtaining very good results by making its own 24 in. taps from Firth-Sterling steel, .038 in. per ft. being allowed for shrinkage. The cost of the 13/16 in. and 12 thread staybolt taps is $2, allowing 25 per cent for overhead charges. About one in fifty is lost by breakage. It was stated that 800 holes per tap should be obtained. One of the members who makes staybolt taps reported that 2,500 holes had been obtained from these taps. The Santa Fe does not permit an error of more than 1/48 of a thread in 6 in. Also the tool must be between .002 in. and .003 in. over size.



Owen D. Kinsey, Sec.-Treas., Tool Foremen's Association

SPECIAL TOOLS FOR STEEL CAR REPAIRS

W. M. Robertson (Ill. Cent.): When steel freight cars were first introduced car department officers felt considerable anxiety relative to the facilities for maintaining them. It was soon found, however, that the problem was not nearly so troublesome as it at first appeared to be. It is the tendency on most roads for the car foreman to rely upon his own resources in the provision of special tools, as he has met with but little consideration from the general tool room and the locomotive department. It seems to be the opinion of the locomotive department that on account of the rough nature of car repair work the requirements in this respect are small, but the contrary is true; on account of the amount of this work handled it should be given very close consideration. Metal workers in the car department are not using jigs and the tools that were common in the locomotive department ten years ago because of the lack of co-operation among the foremen and in the tool department. It seems to me that the tool foreman is the man who can best improve these conditions. [Mr. Robertson then described a number of special tools for use in steel car repairs which have been adopted at the Harahan, La., shops of the Illinois Central,

among which were several that were described in A. H. Hatfield's article on "Riveting in Steel Car Construction," appearing in the *Railway Age Gazette, Mechanical Edition*

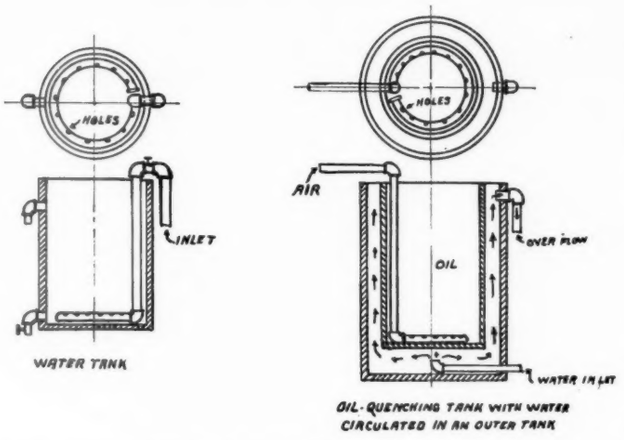


Fig. 1—Water and Oil Quenching Tanks for Heat Treating Steel

in January and February, 1915, pages 33 and 87, respectively.]

The following devices were also described: A simple device for holding journal box bolts while tightening the nut is shown in Fig. 3. This is lighter than an "S" wrench of the size required to hold the head of a journal box bolt and one man is all that is needed to use it.

Fig. 4 shows a "figure four" for use in straightening steel car sills. This is a convenient arrangement for jacking against and it will save considerable time, as it may readily be clamped to the rail.

J. W. Pike, Rock Island Lines, referred to a holder-on for use on the Boyer long stroke hammer. This device, as may be seen from the illustration, Fig. 5, consists of a special head which replaces the usual type of handle on the end of the hammer barrel. In place of the handle the end of the head is fitted with a cylinder of 2½-in. Shelby steel tubing, in which works the mild steel holder-on piston. The length of the piston is increased as desired by a piece of 1¼-in. pipe. The head is fitted with two ⅜-in. air pipe connections, one for the holder-on cylinder and the other for the hammer proper.

E. J. McKernan presented a drawing of the jig for drilling brake staffs, shown in Fig. 6, which is used on the Santa Fe. This consists of a block of soft steel through which are holes for the brake staff; at right angles to these are holes bushed with tool steel for guiding the drills. This jig takes care of all the drilling operations which are required on the brake staff.

Drawings of the jacking stall for straightening steel underframe cars, which has been provided at the Topeka shops, were also shown. A description of these facilities will be given in detail in an early issue of the *Railway Mechanical Engineer.*

J. E. Axley, C. & E. I.: The tool shown in Fig. 7 is used for boring steel and cast iron car wheels. The tools are made from high speed steel and are used in the Davis expansion boring tool holder. They have a ten degree under cut which gives them a good cutting edge. The jig for

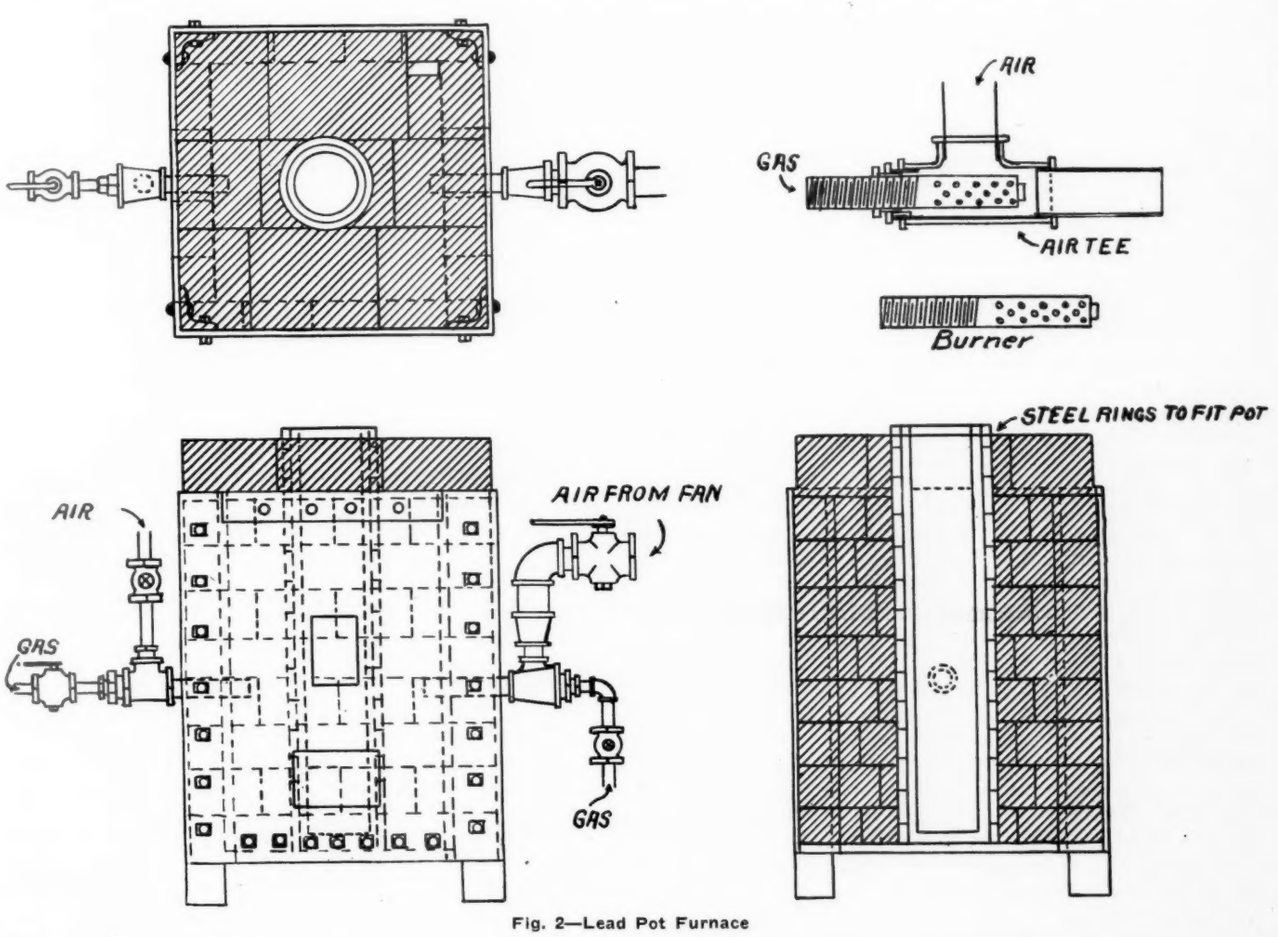


Fig. 2—Lead Pot Furnace

holding the cutter for cutting the under cut is shown in Fig. 8.

RECLAIMING MATERIAL

E. J. McKernan, A., T. & S. F.: All tool steel on the Santa Fe system is reclaimed. The steel is first returned to our Topeka shop for a general inspection, after which such material as is considered serviceable is held in reserve to be made up into small tools as we deem necessary. The short pieces of high speed steel are made into tips for lathe and planer tools, the tips being gas welded to shanks of tire steel. The short ends of old lathe and planer tools are drawn out and made up into square tools for use in Armstrong holders. Only the small chips that are removed in dressing the tools at the blacksmith's anvil reach the scrap, and at this time there is a good market for this class of scrap steel.

All broken high speed twist drills and reamers are reclaimed whenever the pieces are large enough to make this possible; otherwise they are placed in the scrap. A special effort has been made to reclaim all of this steel, which has worked out very economically. Had such a system not been in effect at this time there would have been difficulty in operating all of our machines, due to the shortage of high speed steel. Large washout plug taps that have become slightly worn are returned to Topeka, where they are annealed and recut to the next smaller size. These taps are all kept to standard, the diameters varying in steps of 1/8 in.

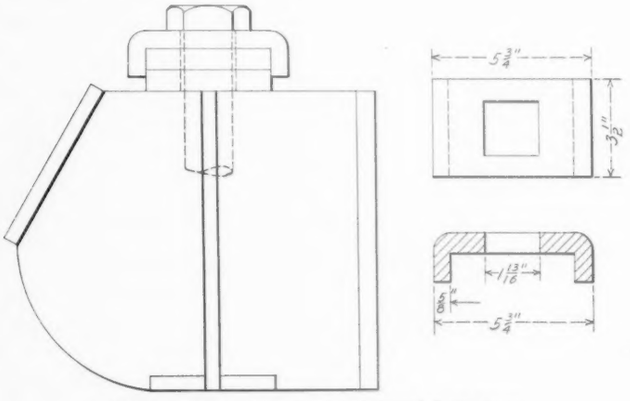


Fig. 3—Device for Holding Journal Box Bolts

All chisels, whether for use by hand or in air hammers, are made up into center punches when they become too short, the minimum safe length for regular service being four inches. Worn reamers are remilled and made to the nearest smaller size.

W. M. Robertson (Ill. Cent.): An air operated vise has proved to be a very useful arrangement for bolt work at the reclaiming plant. The operating mechanism usually consists of two 10-in. air brake cylinders which may be attached to an 8-in. bench vise by removing the hand operating screw. The latter is replaced by a long rod, to the end of which the two operating pistons are attached by means of an equalizer. It is not advisable to use a vise smaller than the 8-in. size because of the hard usage to which it is subjected. In connection with this we use a special air motor-operated arrangement for removing nuts from the old bolts. The motor is suspended over the vise with the spindle attached to an old flexible shaft used for driving tube cutters in the locomotive front end. When not in use the shaft may be swung out of the way to a bracket conveniently placed on the vise.

The pneumatic hammer shown in Fig. 9 will be found to be very useful on the reclamation platform for straightening bolts and also may be used in the blacksmith shop, where better equipment is not available.

DISCUSSION

The discussion on this subject was largely devoted to the reclamation of tool steel, the present condition of the market making the conservation of this material a matter of great importance. The principal use which has been made of small pieces of tool steel has been for tips welded onto the end of soft steel shanks, tire steel usually being used for the shanks. Several methods of uniting the tip and the

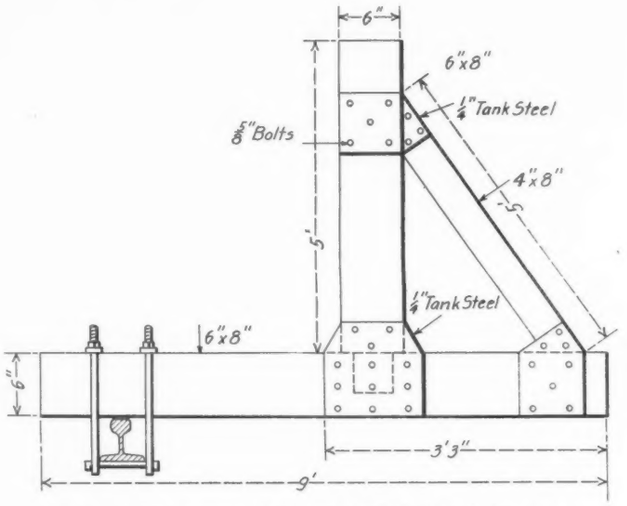


Fig. 4—Jack Support for Straightening Steel Car Sills

shank have been used, including welding in the blacksmith shop, electric welding, gas welding and brazing. All these methods have been used with more or less success, no difficulty usually being experienced except in the case of the larger size tools used on wheel lathes and planers. The oxy-acetylene process has been most generally used, the welds being made successfully in a variety of ways. On the Santa Fe this is no longer considered a reclamation process, as the supply of scrap high speed steel has all been used. The tips are now made from bar stock and are charged at the price of the new material. A tool ½ in. by 1 in. by 8 in.

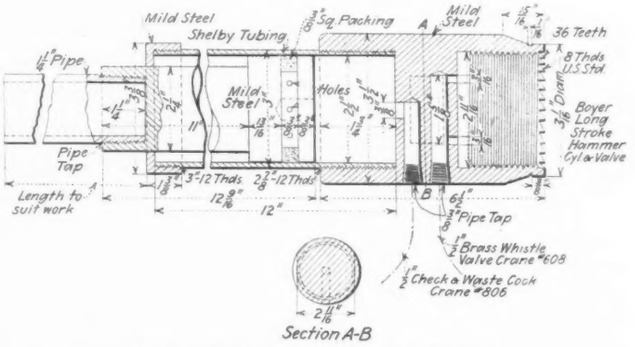


Fig. 5—Holder-On for Pneumatic Tools

can be made complete in this manner at a price of 43 cents as compared with a price of 74 cents for a similar tool of solid high speed steel. A tool 1¼ in. by 2 in. by 14 in. which would cost $9.53 if a solid bar of high speed steel were used, can be made for $3.27 by using a high speed tip on a shank of tire steel. On the other hand it must be considered that the tipped tool has only about one-seventh the life of the solid high speed steel tool, it becoming necessary to reforge the shank and weld on a new tip when the tool has been ground back to within ½ in. of the end of the tip. Mr. McKernan pointed out that on this basis it would not

be considered economical to use the welded tools if it were possible to secure the high speed steel on the basis of the market existing before the war. The following statement shows the various items entering into the cost of a lot of 432 tools, ranging in size from ½ in. by 1 in. by 8 in. to 1¼ in.

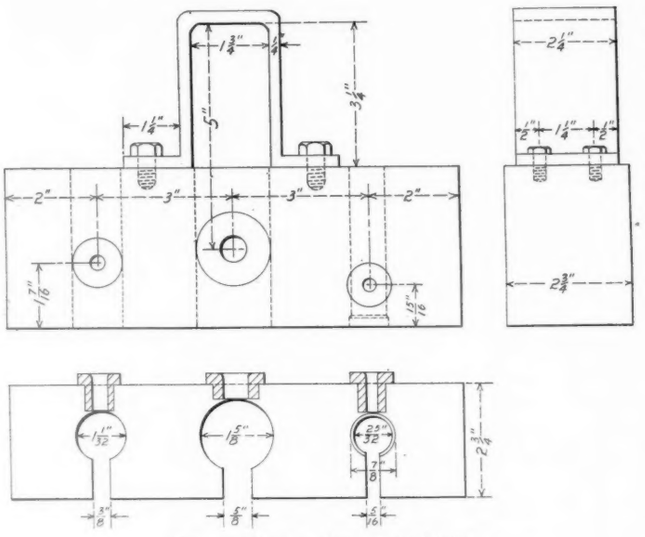


Fig. 6—Drill Jig for Brake Staffs

by 2 in. by 14 in., which were made at the Topeka shops of the Santa Fe:

1,497 lb. tire steel	$15.91
279 lb. high speed steel	164.03
105 lb. No. 2 welding rods	15.75
35 lb. Norway iron for facing the tips	4.55
Total material	$221.24
Total cost, including labor and overhead	$672.14

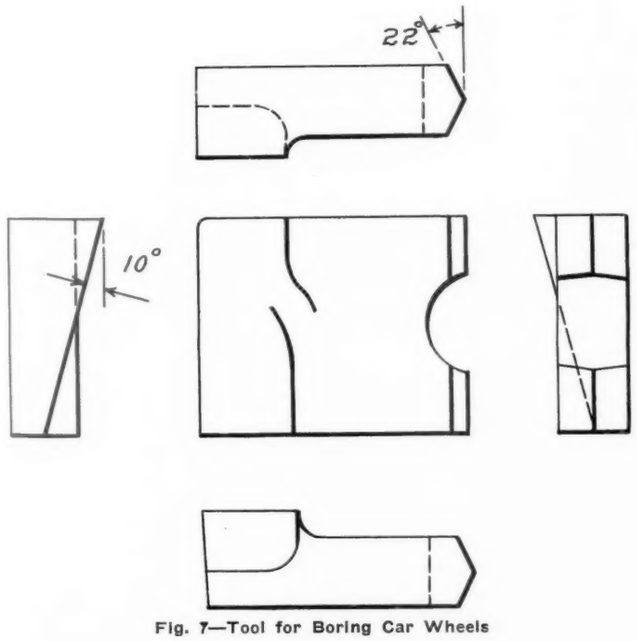


Fig. 7—Tool for Boring Car Wheels

Better results have been obtained in the heat treatment of the tipped tools, owing to the smaller size of the piece of high speed steel to be hardened. On the Santa Fe both the oxy-acetylene and the electric welding process have been tested and it has been found that the results of the former are more satisfactory. The quality of the high speed steel seems to be affected less by the former process.

On the Norfolk & Western the electric spot welding process is being used for this work. The adjoining surfaces of the tip and shank are corrugated and are cleaned before welding. The corrugations facilitate the quick heating of the surfaces by reducing the area of contact through which the current must pass at the beginning of the process. When the surfaces have fused, the tip and the shank are squeezed together and the weld made. The labor cost of this process is very small, as the tools can be welded about as fast as the material can be brought to the operator. The ends of inserted saw teeth which have become too short are used as tips for Davis boring bars, the tip of high speed steel merely being placed on top of the bar and welded by the above process.

Several members have experienced some difficulty in the use of the oxy-acetylene process from the cracking of the high speed steel at a point just above the weld. It was brought out in the discussion that this was probably due to the use of too high a temperature in preheating the tip. Considerable difference of opinion was expressed as to the best methods of doing the welding. In some cases both the shank and tip are ground to provide clean surfaces before

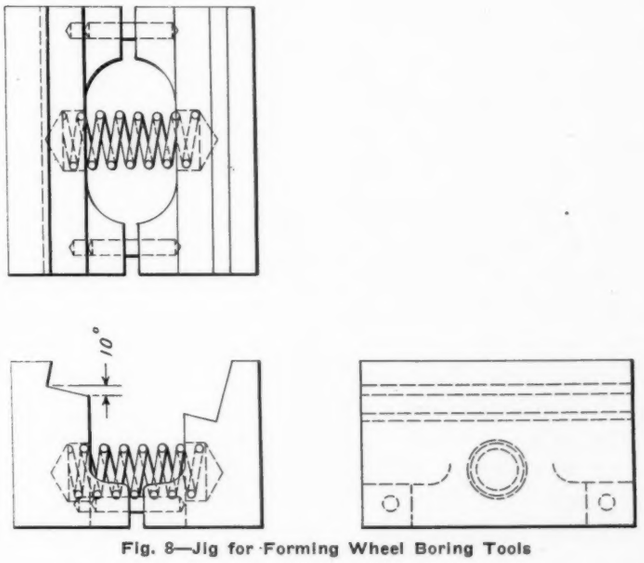


Fig. 8—Jig for Forming Wheel Boring Tools

welding and the tip is faced with soft iron. Others weld directly to the unprepared surfaces, using a welding compound. In several shops it is the practice to fuse and puddle the metal on both surfaces, thus carrying the scale out of the weld and requiring no preparation of the surfaces. After the tips are welded on in this manner the tools may be drawn down to any shape and size required.

The electric welding process is being used on the Southern Railway for this work. The tips are made in dies and are welded to the shank without preheating, the electrode process being used. The tools thus made are used on all the heavy machines. The reclamation of high speed steel has developed so far on this road that the chips which are too small for further use are melted up and worked over into tips.

The brazing process, where used, has been confined to tools of small and medium size.

SPECIAL TOOLS FOR THE FORGE SHOP

George W. Smith, C. & O.: Hundreds of hand hammers have been made in dies under the steam hammer with very good results. A model is made out of open hearth steel on a lathe, and two dies are formed under the hammer. The blocks of the dies are provided with long handles which are connected at the end. The dies are brought up to the proper

heat and the former made on the lathe is placed in the center of the dies under a steam hammer. The impressions in the dies are made in this manner, the former being revolved between the strokes of the hammer. The hammers are made in the dies from open hearth steel rods, a large number being turned out in a short space of time. The hammers having thus been formed are reheated and placed in a forging machine and the eye is punched and the sides flattened in one operation. The fins are ground off on an emery wheel. The hammer is then tempered. These are used for general rough work and are produced at a cost of from six to seven cents each, exclusive of the handles.

Scrapped tires are used for making shear blades, large punches, and dies, the steel being cut to proper length by means of the oxy-acetylene cutting process. The steel possesses enough carbon to take a sufficient temper to do the work and in a majority of cases will stand the wear better than ordinary cast steel. Back-out punches for steel car work are also made from this grade of steel and give very good results.

Vibrating cups for Mallet type locomotives are made out of scrap ends of superheater tubes, the ends being cut to

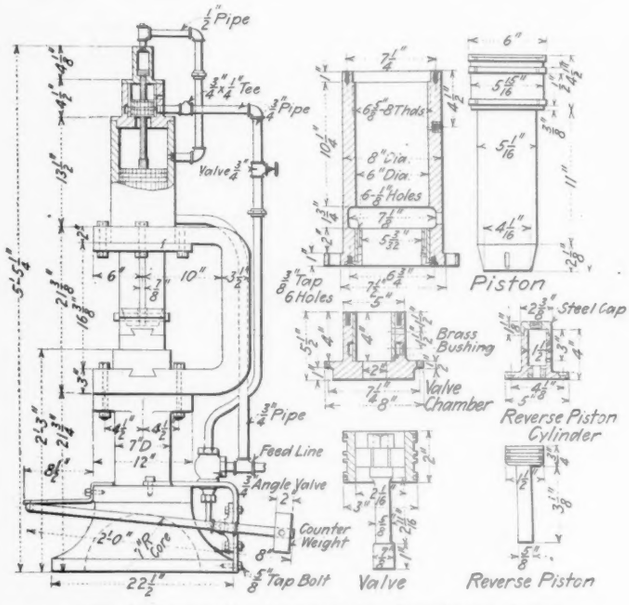


Fig. 9—Pneumatic Hammer for Reclaiming Scrap

the proper length and shaped in a die of the proper shape. They do not require any machining other than trimming up the edges. Hexagonal nuts for crossheads of Mallet locomotives are made out of steel car scrap. The punch and die for making these nuts are made of tire steel. A smooth forging is produced with one blow of the steam hammer. The nuts are reamed and tapped on a turret lathe and no further finishing is necessary.

Spring steel is used for making S-wrenches. A suitable die and punch are made to form the ends and enough stock is left in the center of the wrench to draw it out under the steam hammer to the required length. The ends are punched to the proper size for the nut, and the wrench is bent in a former. These wrenches are strong and light and give very good service, being distributed over the entire system for all classes of work.

DISCUSSION

The use of tire steel as a substitute for carbon tool steel is considered satisfactory in many cases, but opinions vary as to the extent to which the substitution can successfully be made. It has been used successfully for shear blades, the material receiving the same heat treatment that would be accorded to carbon tool steel, viz., a quenching temperature of about 1,450 deg. F., the blade being quenched for a distance of about two inches back from the cutting edge.

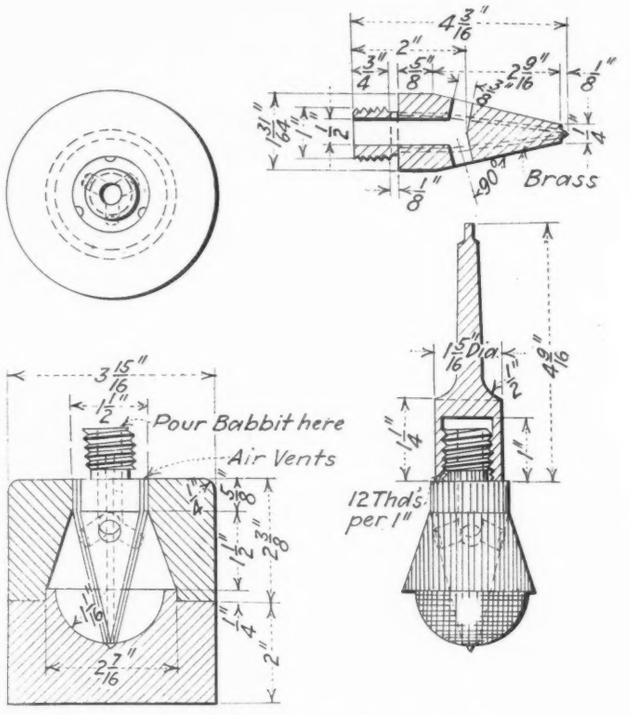


Fig. 10—Grinder for Superheater Header

Several roads use tire steel for forging die inserts and punches, the material being hardened and drawn back to a light straw color. For hot work it is considered superior

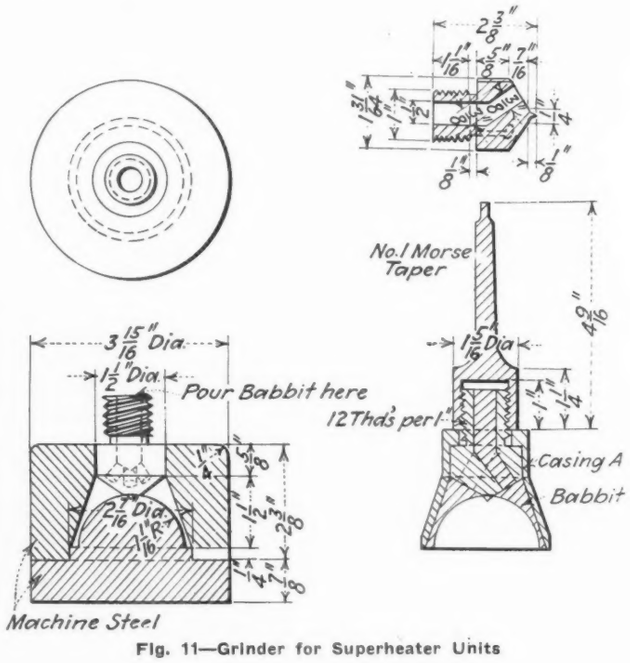


Fig. 11—Grinder for Superheater Units

to carbon tool steel because of its greater toughness and durability under shock. It was not considered generally successful, however, for shear blades subject to use on all kinds of material, owing to the fact that it will not take a

sufficiently high temper to stand up under the harder grades of steel. It is used to a large extent for blacksmiths' swedges and chisels, but in some cases, owing to the tendency of these tools to split as well as burr when made of this material, its use has been discontinued.

GRINDING WHEELS AS APPLIED TO LOCOMOTIVE REPAIRS

H. B. Miller, Big Four: This subject includes the grinding of all tools or machines which are used in the repairing of locomotives. Successful grinding must start with the

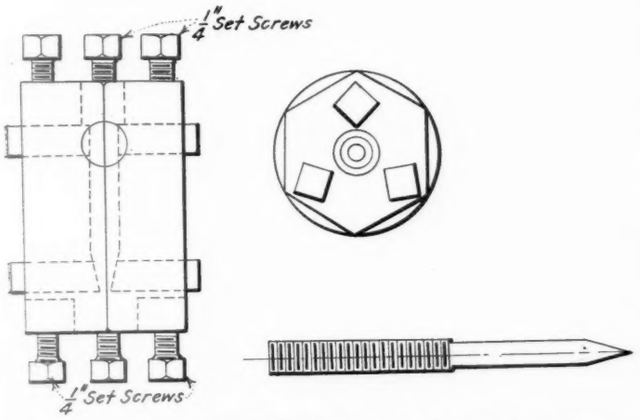


Fig. 12—Box Tool for Refinishing Ends of Gage Cock Stems

condition of the grinding machine, which must have properly fitted bearings and a proper range of speeds and feeds, and must be properly lubricated. The next consideration is the material which we are to grind. The character of this must be known in order that we may select a wheel of the proper grain, size and shape. Much time is saved in grinding by having the proper fixtures with which to do the work. In grinding ball reamers a device that can be moved from the center each way to take care of the radius, the movement being effected by means of a lever, has made it possible to use a ball joint where an angle was formerly used.

In different repair shops the system of handling tools

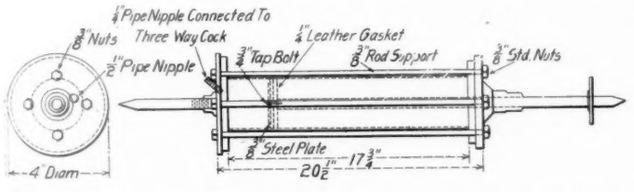


Fig. 13—Jack for Removing Expanded Tires in the Roundhouse

must necessarily be adapted to the working conditions of the shop, but the grinding should be done in the tool room, the tools being placed in the checking room for distribution. As the tools are used and returned they should be checked over, re-ground and re-marked if necessary, after which they should be placed in the checking racks. An essential point in grinding tools is the provision of the proper degree of clearance for the work to be done by the tool. We find a difference in the cutting qualities of straight and spiral reamers with the same degree of clearance. In this case we are using a standard degree of clearance on each tool according to the work for which it is intended, as we have found that too much clearance and no clearance are equally worthless.

A. Sterner (C., R. I. & P.): Although the application of grinding to the finishing of piston rods and crank pins appears to be unlimited, experience seems to indicate that the old practice of turning and rolling is better. This is due to the fact that the tough material of these parts retains particles of the abrasive, the bad effects of which are very well known. Parts which do not have any severe work to do, and which are required to have a finished or semi-finished surface, should always be made with as little stock as possible and may be finished by grinding. Working surfaces should not be ground unless they are carbonized, chilled or tempered.

The efficiency of all grinding wheels depends upon their speed and the ability to make every grain on the surface work. The speed must not be too fast, however, as this causes the binding material to melt and the surface of the wheel becomes glazed.

Do not use a grinding wheel with a spindle worn loose. With four or five double thicknesses of lacing on the belt it is not difficult to figure out the result. Do not mount it on a stand which is not securely held down. Never allow water to leak on a common emery wheel or keep it in a hot



Fig. 14—Lubricating Tank for Pneumatic Hammers

place, as it contains glue. Do not run it at speeds other than those recommended by the manufacturer, and always follow his recommendations as to the type of wheel to be used for various classes of work.

When a grinder is used under other conditions than these it is being abused and is a constant source of trouble. On the other hand, if these simple facts are kept in mind emery wheels are the most useful tools to be had.

DISCUSSION

The question arose as to whether or not the grinding of piston rods and air compressor rods affected the life of the packing, especially where metallic packing was used, it being claimed that the grains from the grinding wheel would penetrate the pores of the steel rod and thus score the packing. It was claimed by the representatives of grinding wheel manufacturers who were present during this discussion that this was not true as has been repeatedly proved by tests. Where grinding wheels are used for this purpose, however, care must be taken to have them true to diameter with no high spots and they must be run at the proper speed. Some roads prefer rolling the rods to grinding them

claiming that a smoother surface can thus be obtained.

The question of the maintenance of the grinding wheels also received considerable discussion. Several roads detail a man, such as the belt foreman, to make daily inspections of the grinding wheels throughout the shop. It is his duty to keep them properly dressed and well lubricated. It is also necessary to keep the peripheral speed as nearly constant as possible. This is done by removing badly worn wheels and applying them to machines of higher speed. For instance, the practice on the Santa Fe is to remove a 24-in. wheel when it has worn down to 16 in. and apply it to a machine having a greater speed. Every step possible should be taken to prevent the workmen from abusing the grinding wheels. Wheels should be provided for both rough and fine work, so that the good wheels will not be ruined for the fine grinding.

JIGS AND DEVICES FOR THE ENGINEHOUSE

A. Connell, Kansas City Southern: Until recently the use of special tools and jigs for doing the various kinds of work in the roundhouse was unknown, with the exception of an occasional tool made by individual workmen. The back shop received all the attention, the workmen there having many useful special tools. Because of this condition the term "roundhouse job" was commonly used to indicate work that was half done or done just well enough to last one trip of the engine, and it was customary for men in the roundhouse to spend several times as long in doing their work without special tools as would have been required with them. Considerable credit is due the Tool Foremen's Association for the development of tools and jigs for the roundhouse.

Figs. 10 and 11 show a very successful superheater unit grinder for roundhouse use. There are two grinders in the set; one for the ball on the end of the superheater unit and the other for the socket in the header. These are made up of steel centers on which are cast the babbitt grinding surfaces in the special moulds, as shown. These are arranged to be threaded into the end of a No. 1 Morse taper shank and, like all babbitt grinders, may be easily renewed.

F. D. West (C. G. W.) showed a number of special tools for the enginehouse. A box tool for refinishing the ends of leaky gage cock stems is shown in Fig. 12. This has two sets of cutters, the first set turning off the threads and the other tapering the end of the spindle. This has the advantage that it always maintains the proper relation

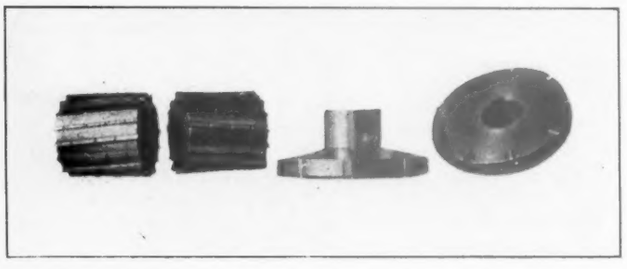


Fig. 15—Milling Cutters and Valve Chamber Boring Cutters

between the inner end of the threads and the seat. It may easily be used by hand and it can be used in making new stems. In the latter case a brass rod of the required size is threaded for its entire length and then cut up into suitable lengths. These are gripped in a drill press chuck and run down into the tool.

Fig. 13 shows a tire removing device which is in fact a special type of air jack. After the tire has been heated and expanded the end of the jack is placed against the inside face of the opposite tire. The plunger pushes the tire off and is prevented from traveling out too far by a 3-in. collar which strikes the wheel center.

DISCUSSION

Several of the members spoke strongly in favor of the tool foremen giving their best thought to devising special jigs and tools for use in the enginehouse, for the need of such things in the enginehouse is very great. Every means should be given the enginehouse force to make quick and thorough repairs, for then the power would be kept in service longer and would be able to make a greater mileage between shoppings, all of which means a more efficient mechanical department. It was designated as the "emergency hospital," for the locomotive and the "doctors" therein should be provided with satisfactory tools. The outlying enginehouses should be given even more assistance than

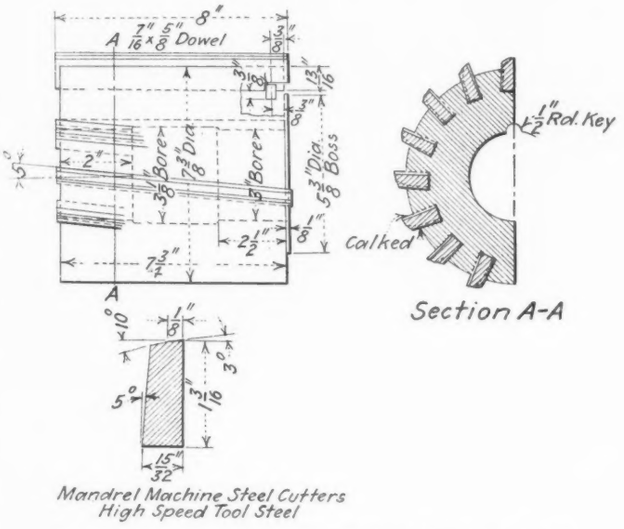


Fig. 16.—Details of the Milling Cutters Shown in Fig. 15

those at or near the back shops, for at these points in case of emergency the proper equipment can be borrowed while the outlying enginehouse would have to either hold the engine for a much longer time or send it to the main shop.

Several special tools used at some enginehouses were mentioned, among them being a tool for grinding superheater unit joints. It consists of a fluted ball of proper contour provided with a square pilot projection. A piece of emery cloth is placed over this ball, the square pilot keeping it from rotating, and the joint ground. The tool will never wear out, the wear coming wholly on the emery cloth, which is replaced after having served its purpose. J. C. Bevelle told of using a floating liner in the back end main rod brass which on some engines eliminated the necessity of renewing the brasses at the end of every trip.

TOOL ROOM EQUIPMENT AND TOOLS

J. C. Bevelle, El Paso & Southwestern, El Paso, Texas. —Fig. 14 illustrates a very convenient method of handling pneumatic riveting and chipping hammers. This is an oil tank with two compartments, one for the chipping hammers and the one below for the riveting hammers. The hammers are returned to the tool room at the end of each working day and placed in this tank for the purpose of lubricating them. They are submerged in the oil and remain there until the following morning, when they are lifted out and allowed to drain. The top section has a 7/8 in. round rod in the center and at the top of the tank extending from one end to the other. On this the hammer rests and drains.

The lower section is made in a triangular shape, having an opening on the front of about 6 in. This is used for the riveting hammers. They are also drained by being stood up, as shown, and held in position by a spring clip. The

throttle lever rests against a 1 in. angle iron which supports the hammer and also holds the throttle valve open, allowing the oil to drain out of the hammer. Each hammer is numbered and has its place in the tank. Each time the hammers are returned to the tool room they are submerged in the oil. This keeps the tools properly lubricated and reduces the cost of repairs about 50 per cent. The tank is set on rollers so that it can be moved to the most convenient location. It has a galvanized iron top so that it can be closed and keep the oil from getting dirty. Also the oil is less apt to catch fire from any spark from an emery wheel, etc. The tank frame is made of 3/8 in. by 2

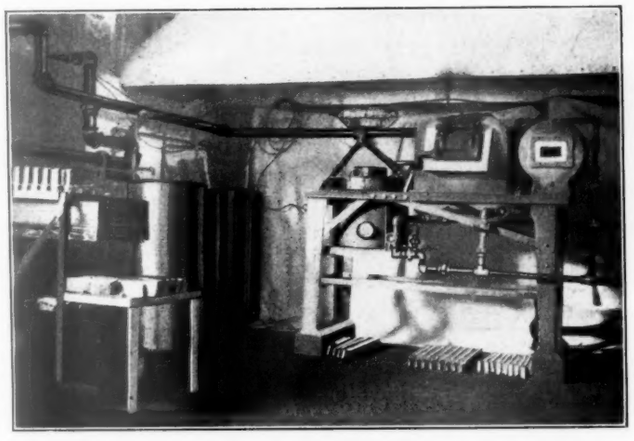


Fig. 17—Interior of Tempering Plant for a Small Shop

in. angle iron and the tanks are made of 1/8 in. tank steel. The oil used is a mixture of one-third kerosene and two-thirds lard oil.

Fig. 15 illustrates a pair of milling cutters on the left, and two valve chamber boring cutters on the right. Fig. 16 is a drawing of the milling cutters and is self-explanatory. The milling cutters are used for general slab milling and are very efficient and economical. They are made of high speed steel blades inserted in a soft steel body, and, when working, can be used singly or in pairs. When placed together on the arbor they measure 16 in. over all. This covers the average run of work. The blades are set in with a dovetail and on an angle of 5 deg. as shown in Fig. 16. The blades lap in the center so that they make a very smooth cut. They have taken the place of solid cutters and also peg milling cutters in this shop. They will produce a heavier chip and smoother surface than the peg cutters that we have used. They are easy to handle on the grinding machine, as they are not so long and heavy as the others and it is easy to replace the blades when they are worn out.

The two valve chamber boring cutters shown on the right in Fig. 15 are used on a regular portable boring bar and are used instead of the spider with boring tools. We have three for each size of valve chamber; for instance, a 12 in., 12 1/16 in. and 12 1/8 in. When the chamber is re-bushed we use for the first boring the 12 in. cutter, for the second boring the 12 1/16 in. cutter, and for the third boring the 12 1/8 in. cutter. Each boring is done with one cut and a heavy feed and a finish is produced in the chamber that cannot be done with the spider and boring tool. The accuracy of the tools is maintained in the tool room and when the chambers are bored they are exactly to size and do not have to be calipered or bothered with by the operator. This also standardizes the valve chambers, making them a given size, and when they are bored they are lettered clearly on the outside, *A*, *B*, or *C*. The letter *A* signifies that the bushing is of its original size, the letter *B* signifies that it has been re-bored once; the letter *C* signifies that it has been re-bored the second time. With this standard it is only necessary to carry three sizes of packing rings, sizes *A*, *B*, and *C*. The rings are turned after being cut, so that they are perfectly round and fit the chamber. These cutters are made with high speed steel blades inserted in a cast iron body.

Figs. 17 and 18 show a very efficient tempering plant for a medium sized railroad shop. It consists of a furnace with three sections for hardening; a crucible section, an oven section and a forge section; a tempering oil bath furnace, quenching tanks and table for the tools. The hardening furnace is equipped with a high resistance pyrometer, with a thermo-couple leading to each section. The tempering bath is equipped with a thermometer, registering up to 650 deg. Each section of the hardening furnace has heavy linings so that it can be used for hardening high speed steel. The crucible section can be used for hardening with molten lead or borium chloride; also, small tempering can be done in this section. The oven section is used for hardening dies, milling cutters, large taps, etc., and the forge section is used for hardening machine tools, although its range of work is very wide.

The tempering bath shown at the right in Fig. 18 is one of the most valuable tools in a shop. A large quantity of tools can be placed in this bath and the temper drawn to an exact point. It is customary to harden all tools on hand to be hardened and draw them all by one heating of the tempering bath. Different tools require different drawing. This is done with small wire baskets so that the tools can be taken out as they reach the required temperature. In the left hand corner of Fig. 17 are the quenching tanks, one for clear water, one for salt water and one for oil. These are equipped with screen pans, so that the tools can be raised out of the liquid and allowed to drain. The oil tank is equipped with a coil of pipe in the bottom, connected with the blower line, which keeps the oil circulating, thus giving the tools a more uniform hardness. The tanks are made from old air drums taken from scrap. This plant is in the tool room and under the tool room foreman's charge. The hardening furnace is also used for pre-heating high

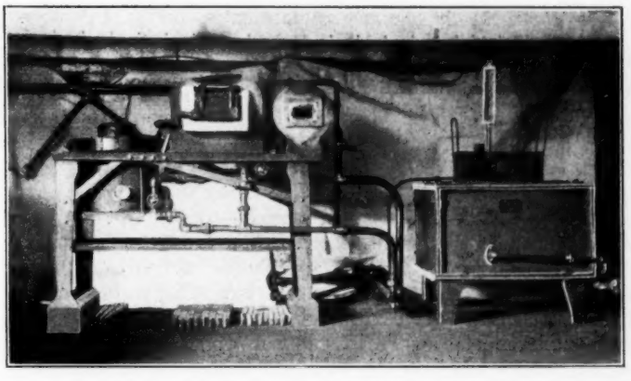


Fig. 18—Another View Showing the Heat Treating Equipment

speed steel tips and tool shanks, when they are to be made into machine tools, one section heating the shank to 1,450 deg., and the other section heating the tip to 1,850 deg. These furnaces are operated with manufactured gas.

ADDRESS BY MR. CARNEY

J. A. Carney, superintendent of shops, Chicago, Burlington & Quincy, addressed the convention in part as follows:

I do not want to take up your time in going into the details of how you should hold your file, the construction of tools and things of that sort that you all know more about than I do. What I want to touch on is not so much details as it is the matter of toolrooms in general. The function of a tool-

room is to look after the tools which are used by the productive workers in the shop, whether it be a machine shop, a locomotive erecting shop, or a car shop. I have in mind one toolroom which is in charge of one man. He occupies a room about 10 ft. square and his sole duty is to repair cutters for bolt trimming machinery. I have in mind another toolroom that has more machinery in it than we have in the Aurora shops of the Burlington. These are the two extreme limits.

The province of the toolroom is to make the tools that are needed, to maintain them in such a condition that when they are wanted they are ready to be given out, and to have them at hand so that there will be no delay to the men who call for them. I had an experience some years ago that illustrates this point. We had a hurry-up job, and it was not done on time; on investigating the matter the excuse was made that "we could not find our tools." I had occasion to look into this matter in detail and I found that the statement was true. It had been the practice for each man to get the tool that he wanted, to use it, and then throw it down on the floor. If someone else wanted this tool and remembered who had used it last he might be able to find it on the floor; if he did not find it there he kept on hunting until he did find it. The result was an enormous amount of time wasted in chasing up tools. There was no toolroom for this particular department and never had been. I asked the men whether they would use a toolroom if we would give them one, and they agreed to do so. So a toolroom was built. This was not a manufacturing department and there were no machine tools required; the toolroom was simply a place to keep the special articles that were needed at various times in the work of the department. When they took a tool out of the toolroom and used it, a majority of the men would put it back. A few, however, said they did not have time to do this. I told the majority of the men who are living up to the rules that I did not want to say anything to the others, but that every time they found a man dropping a jack, a special bar, or whatever it might be on the platform and going away and leaving it, I wanted them to get after him. They did this and the second day we had no more trouble of this kind.

The toolroom can be a great factor in the safety movement. As you know, the men who use hammers, chisels, etc., have their own kits. These tools become dull, the heads become burred and the tools are unsafe. I think everyone can recall someone who has had an eye injury or who has cut himself badly from the cracking off of the head of a cold chisel. If the toolroom will carry in stock a lot of cold chisels, sharpened and ready to be delivered, the men may be saved a lot of time. When a man turns in his defective chisels the ones which he receives are ready to go to work. He does not have to go to the grindstone or run over to the blacksmith shop and spend a lot of time getting them dressed. That is the thing I have in mind: the importance of the toolroom in having things ready and in good condition when wanted. The motto of the toolroom should be "a place for everything and everything in its place." That refers to everything from the commonest cold chisel up to the most complicated tools that can possibly be made.

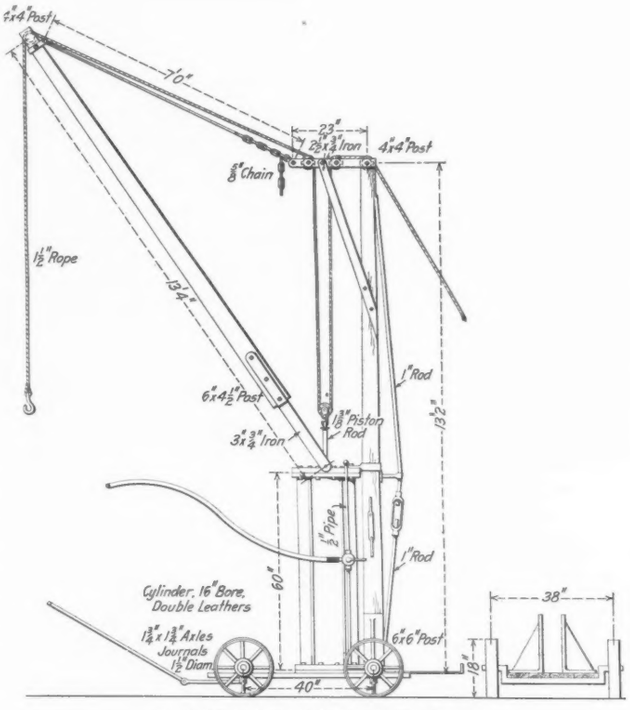
OTHER BUSINESS

The following officers were elected to serve for the ensuing year: President, C. A. Shaffer, Illinois Central, Chicago; first vice-president, J. C. Bevelle, El Paso & Southwestern, El Paso, Tex.; second vice-president, W. M. Robertson, Illinois Central, New Orleans, La.; third vice-president, J. B. Hasty, Atchison, Topeka & Santa Fe, San Bernardino, Cal.; secretary-treasurer, R. D. Fletcher, Belt Ry. of Chicago, Chicago; chairman of the executive committee, B. Henrickson, Chicago & North Western, Chicago. The association voted to hold its next convention in Chicago.

PORTABLE AIR HOIST

BY E. A. MURRAY
Master Mechanic, Chesapeake Ohio, Clifton Forge, Va.

The accompanying engraving shows a form of portable air hoist suitable for roundhouse work in cases where the type of floor used permits of its use. This hoist was made in the shops at Clifton Forge and is used for lifting engine fronts, air pumps, smokestacks, etc. The construction is clearly shown in the illustration. The cable which is shown with a broken end is secured to the cleat on the vertical wooden post



Portable Air Hoist for Roundhouses

in front of the air cylinder. When the hook on the end of the cable is made fast to the object to be lifted the piston in the cylinder is at the top of its stroke; when the slack is taken out of the cable it is fastened to the cleat.

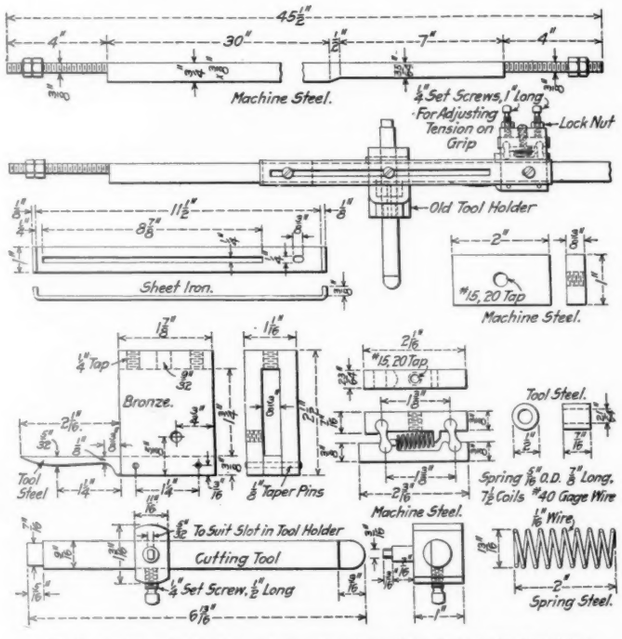
Brittleness of Annealed Copper.—This was the subject of a paper at the annual convention of the American Electro-chemical Society. The conclusion was drawn that brittleness of copper developed during heating in the process of manufacture and frequently ascribed to "burning" is in reality a deoxidation. With ordinary commercial copper, serious brittleness begins to appear at 400 degs. C. in dry hydrogen, at 600 degs. C. in wet hydrogen.—*American Machinist.*

Determining Cylinder Clearance Travel.—Clearance travel in a steam or ammonia cylinder may be determined by inserting a piece of lead or soft solder wire between the piston and the head so that it will be flattened between at the end of the stroke. The amount of clearance is then found by a micrometer. This thickness of the flattened wire expressed in fractions of an inch, divided by the stroke in inches, gives the percentage of clearance. If the volume of the clearance space is to be determined, the machine is turned over so that the piston stands at the end of the stroke, the exhaust valve is closed, and the space is filled with oil. This gives the volume or total clearance. As a check the oil should be measured both as it goes in and as it is drawn out of the cylinder.—*Power.*

New Devices

ADJUSTABLE DETHREADING ATTACHMENT FOR STAYBOLT MACHINES

The operation of the reducing or dethreading tools, by which the threads are turned off the body of the bolt in Lassiter staybolt machines, is automatic for each length of bolt but a separate set of profile strips is required for each length of bolt, these strips being removed and replaced whenever the bolt length is changed. This not only requires the maintenance of a large stock of profile strips but involves the loss of considerable time in changing and adjusting the strips. An attachment for this machine has been patented by S. L. Gary, 401 West 33rd St., South Richmond, Va., which is designed to overcome these difficulties. This attachment provides a single set of adjustable profile strips



Dethreading Attachment for the Lassiter Staybolt Machine

which may quickly be set for any desired staybolt length, adjustment also being provided for variations in the length of thread at either end of the staybolt.

In the Lassiter machine the staybolt is held in a vertical position by a chuck at the lower end and revolved about its own axis. The threading dies are contained in a sliding head, guided by two vertical rods and fed by gravity. The dies are opened and closed automatically, closing in the upper position through the action of an adjustable lug secured to one of the vertical guides, and opening at the end of the cut in a similar manner. In addition to the dies the cutter head also contains two horizontal cutting tools placed opposite each other, the cutting ends of which are normally held away from the surface of the staybolt by means of springs in the head. A roller attached to the shank of each of these tools bears on the surface of a vertical control bar one of which passes through each side of the head and is rigidly fixed at the top and bottom parallel to the guide rod. By means of profile strips, properly located on the edges of the control bars, the rollers are forced out from the bars and the cutters are fed into the staybolt at any desired distance below the upper end. As the dies feed downward the cutting tools continue to remove the threads from the body of the bolt until an offset near the lower end of each control bar is reached. These permit the springs in the head to draw the cutting tools back from the work, thus leaving the threads on the lower end of the bolt.

The drawing shows the details of the adjustable profile attachment. One of the cutting tools is shown but the details of the head are not included as the standard Lassiter head is used. At the top of the drawing is shown one of the control bars, which is made from machine steel and finished to a ¾-in. to ⅜-in. section for the greater part of its length. For a short distance at the bottom the depth is decreased from ¾ in. to 35/64 in. The profile strip is made from tool steel and bears against the edge of the control bar. It is held in place by a U-shaped bronze slide and a toggle clamping device which automatically grips the bar and normally prevents the profile strip from sliding downward.

By referring to the details of the clamping device it will be seen that it consists of two rectangular blocks separated by two small struts, recesses for the ends of which are provided in the adjoining faces of the blocks. When the wedge is in place in the slide the outer block is prevented from moving vertically with respect to the slide by means of a tap screw passing through the back of the slide. A coil spring, 2 in. long, is placed between the blocks, one end bearing against a shoulder on the inner block and the other against a shoulder on the outer block, the spring tending to move the inner block upward and thus bring the toggle action into play. The gripping power of the device may be adjusted by means of two set screws through the back of the slide, which bear against the outer block.

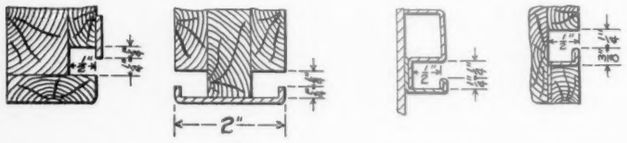
When assembled on the control bar a slotted plate is attached to the slide, a screw on the cutter head sliding freely in the slot. The length of the slot may be adjusted by means of a sliding block at the upper end, which may be clamped in any position desired. In operation, the screw on the cutter head will be at the top of the slot as the dies begin their downward feed on the body of the staybolt. As the head feeds down the rollers on the dethreading tools will strike the profile strips and be forced out from the control bars, thus causing the tools, which follow directly after the threading dies, to be fed into the staybolt. It will be noted that the inner block of each profile strip clamping device projects slightly above the top of the slide. As the head moves downward it strikes the ends of these blocks, thereby releasing the profile strips and permitting them to move down with the head. When the slides reach the offsets in the control bars the springs in the cutter head will force the profile strips into the offsets, which permit the ends of the tools to clear the staybolt for the remainder of its length.

When the bolt is finished the dies are opened automatically and the head is then moved up to permit the removal of the finished staybolt and the insertion of another. Until

the screws in the sides of the head reach the top of the slots the profile strips will remain at the bottom of the control bars; then they will be pulled up, the clamps being released automatically by the lifting of the slides. The length of the slots thus determines the length of the threads on the upper end of the staybolt. The length of the threads at the lower end of the bolt is determined by the height of the offset in the control bars. This may be adjusted by moving the bars vertically in their supporting lugs, the ends of the bars being threaded for that purpose.

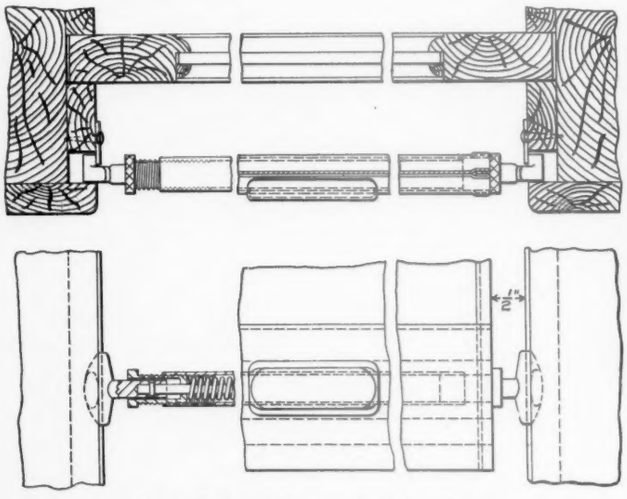
ACME ENCLOSED GROOVE CURTAIN FIXTURES

The Acme Supply Company, Chicago, Ill., has recently placed on the market a new curtain fixture, the interesting feature of which is the arrangement preventing the curtain from being accidentally removed from its groove. This is accomplished by placing a retaining strip over the groove, as shown in the illustrations. Metal shoes on the fixture at the bottom of the curtain are provided with flanges, which



Styles of Groove Construction

are held in contact with the retaining strip by springs located inside the fixture tube. No pinch handles are required to operate the curtain, and it can be raised or lowered from any point along the bottom. It automatically retains its alinement in the horizontal position and the fixture stays inside the groove where it belongs. The springs in the fixture tube cause the flange on the metal shoe to clutch the retaining strip firmly enough to prevent the creeping of the

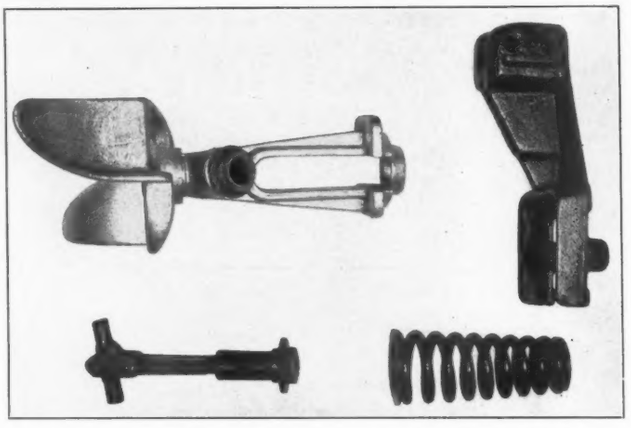


Acme Enclosed Groove Curtain Fixture

curtain under any service conditions. The groove recommended for the use with this fixture is shown in Style 1. It is ½-in. wide by ½-in. deep, with an opening 5/16-in. wide. Special fixtures, however, can be furnished which will operate in grooves ⅜-in. by ⅜-in., but the ½-in. width is preferable. There are four styles of grooves illustrated to accommodate the various types of car construction. The fixture can be adjusted for proper tension without removing the curtain from the groove.

THE ROBINSON TRAIN LINE CONNECTOR

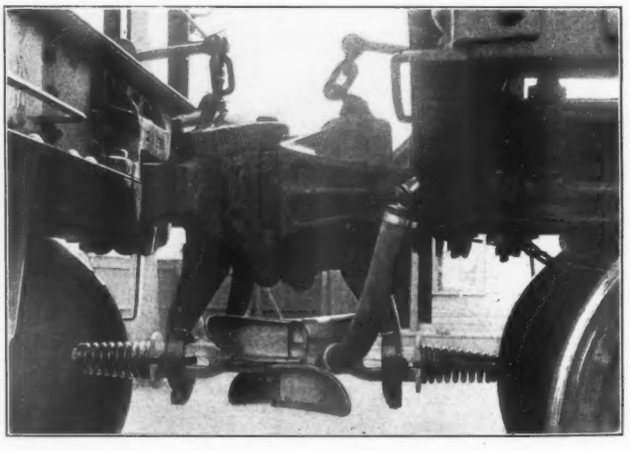
The illustrations show the Robinson automatic connector for both freight and passenger train lines as it is now manufactured after several years of development, by the Robinson Connector Company, Branford, Conn. A number of these connectors have been in use on the Canadian Northern for several years, where they are said to have met the conditions imposed by the severity of the climate obtaining in



Details of the Robinson Connector

the territory through which that line operates, and their use is being extended.

Referring to the photograph of the parts, it will be seen that the connector is made up of but five pieces; the head, the spring, the bolt, the pivot bar and the arm which supports the connector from the coupler head. In assembling, the bolt, with the pivot bar in place, is first passed through the hole in the end of the head, the ends of the pivot bar being provided for by the longitudinal opening through the



The Operation of the Freight Car Connector

shank of the head. The head is then placed in the arm with the flange bearing against the rear face of the jaws and the ends of the pivot bar seated in pockets in the jaws. When the spring is placed on the bolt, the whole device is held securely in place, the front end of the spring bearing against the end of the head and the rear end against a collar on the end of the bolt. It will be seen that the tension of the spring presses the flange of the head securely against the face of the arm and thus normally supports the head in a horizontal position.

The supporting arm is bolted to a lug on the under side of the coupler head. This lug may be gas-welded to existing couplers while on new ones it may be cast integral. When

attached to the coupler the gaskets in the contact face of head should be from 1½-in. to 2-in. ahead of the inside face of the coupler knuckle when closed, this being the amount of compression to which the connector spring is subjected when the cars are coupled. The spring is designed to produce a pressure of about 600 lb. per inch of compression, the force holding the connectors together, therefore, being about 900 lb. to 1,200 lb.

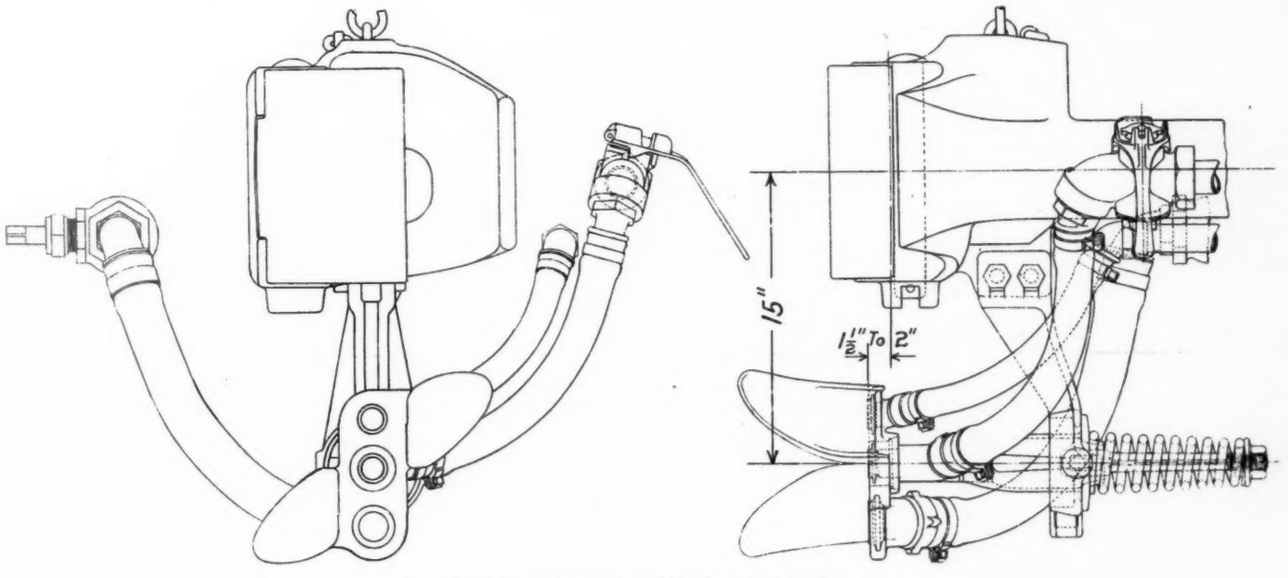
One of the illustrations shows the position of the heads when the cars are coupled. By the compression of the springs the flanges at the rear ends of the heads have been moved back from the face of the supporting arms, thereby providing for complete angular flexibility of the two heads, acting as a unit. The only resistance to angular movement is the slight friction between the bolt and the pivot bar and the friction at the pivot bearings of the latter. As this never amounts to more than a few pounds while the vertical faces of the heads are held together by 900 lb. direct pressure, it is impossible for them to be separated by any movement between the adjoining coupler heads, either vertical or angular.

The operation of the gathering arms will be clearly understood from the illustrations. They are designed to insure the positive action of the device under all conditions of service, operating without difficulty on curves up to 34 deg. and with variations of 4 in. in the height of the opposed couplers.

The hose used is M. C. B. standard with the exception of the length of the steam and signal hose, these being somewhat shorter than the standard. The signal and brake hose are coupled to the connector head by a union of the bayonet joint type, which requires but a quarter turn to the right or left to couple or disconnect. The hose end of this union is fitted with a special type of gasket which tends to tighten under pressure and insures freedom from leakage at this point. The steam hose is coupled to the connection by a threaded union which is easily disconnected with a wrench or hammer. Special interchange couplings are provided for use in making connections with cars not equipped with the Robinson connector. These consist of short sections of metal tubing, to one end of which is threaded a hose coupling of the standard type and on the other end of which is provided a bayonet coupling to fit the socket on the end of the hose in the case of the signal and brake hose, and a threaded union in the case of the steam hose. The hose is first disconnected from the connector head and the interchange coupling is then inserted, a spring latch being provided on the latter to prevent accidental disconnection.

The connector head is designed for use with a single hose connection on freight equipment and with three connections on passenger equipment. The drawing shows the passenger car connector. The brake hose connects to the middle opening while the signal and steam hose connections are placed above and below it respectively. With the exception of the addition of connections and ports for the latter two lines, the passenger equipment is practically the same as that for freight cars. Standard M. C. B. gaskets are used in the signal and brake ports while special rubber gaskets with high heat resisting properties are used in the steam ports. All are easily inserted or removed.

The passenger car connectors have a total weight of 40 lb., while the weight of the freight connector is 35 lb. With the exception of the spring, the parts are all malleable iron castings, the head being galvanized to prevent corrosion.



The Passenger Connector Attached to the Coupler

THE "GUN" TAP

On page 429 of the August, 1916, issue of the *Railway Mechanical Engineer* there was published a description of the "Gun" tap, manufactured by the Greenfield Tap & Die Corporation, Greenfield, Mass. We are informed by the manufacturers that the statement that this tap gets its name from the fact that it was originally designed for use in gun work, is incorrect. The tap is so called because of the fact that the shearing action of the cutting teeth deflects the chips and throws them straight ahead of the tap in long unbroken curls. This action gave rise to the name.

CEMENT FOR STEAM PIPES.—Cement of specially valuable properties for steam pipes and for filling up small leaks such as blow-holes in a casting, without the necessity of removing the injured pieces, is composed of 5 parts by weight of paris white, 5 of yellow ocher, 10 of litharge, 5 of red lead and 4 of black oxide manganese, these various materials being mixed with great thoroughness, a small quantity of asbestos and boiled oil being afterward added. The composition, as thus prepared, will set hard in from two to five hours and possesses the advantage of not being subject to expansion and contraction to such an extent as to cause leakage afterward, and its efficiency in places difficult of access is important.—*Power.*

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WE GUARANTEE, that of this issue 9,100 copies were printed: that of these 9,100 copies, 7,213 were mailed to regular paid subscribers, 108 were provided for counter and news companies' sales, 485 were mailed to advertisers, exchanges and correspondents, and 1,294 were provided for new subscriptions, samples, copies lost in the mail and office use: that the total copies printed this year to date were 74,300, an average of 8,255 copies a month.

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The Chicago & Alton has made an increase of 1½ cents an hour in the wages of its car shop employees.

In a fire at Boston, July 25, the Boston & Maine lost a dining car and seven day coaches; estimated total loss $25,000.

The president of Cuba has signed a bill providing for a commission to study the question of government ownership of railroads in Cuba.

One of the scale-testing cars of the United States Bureau of Standards has been testing track scales used by the railroads and industries around Chicago.

The Southern Pacific has 105 dining cars, 63 buffet cars, four cafe cars and one lunch car. Its dining car mileage last year was 10,832,847, and 3,207,353 persons were fed on the diners.

The Buffalo, Rochester & Pittsburgh Railway Employees' Magazine for August contains an article descriptive of a high speed locomotive with slide valves which is operating successfully on that road using high degree superheated steam. This engine has just completed 30,000 miles in difficult passenger service.

Through its safety committee the Nashville, Chattanooga & St. Louis has inaugurated a campaign against "train hopping." Within a period of two weeks recently, two boys were crippled while trying to catch rides on freight trains of this railroad. "Hopping" is usually practiced by the boys of the smaller communities. Arrests have proved only a temporary preventive, the danger seldom being realized until injury or death results, in which case a lawsuit usually follows. The central safety committee of the road has conceived the idea that a direct appeal to the parents, stating specific cases, such as the two accidents above referred to, will bring results.

The Pennsylvania Railroad, in a circular calling attention to the need of checking infantile paralysis, recommends that certificates be procured from the proper health officers for all children under sixteen years of age before buying tickets to any point. In the region of New York City and Philadelphia, additional quarantines are being constantly established, and in all directions children are likely to have their journeys cut short by the quarantine officers. The Baltimore & Ohio, whose cautionary circular to employees was issued July 10, soon after the epidemic began to spread from New York City to surrounding places, set forth in succinct fashion what is known as to the cause and the prevention of the disease, with advice as to proper hygienic measures.

The Baltimore & Ohio, to aid in the Ohio state campaign to protect citizens engaged in industrial employment against accidents, has notified Victor T. Noonan, director of safety of the Ohio Industrial Commission that it will tender the use of a passenger coach and will arrange for its transportation. The car will be fitted up with exhibits showing what the manufacturing and industrial concerns are doing to provide for the safety of their workmen. In the windows of the car there will be shown a series of transparency views illustrating some of the things that have been done by this road in the interest of "safety first." It is planned to have the car cover the state, visiting numerous localities which were not reached by the train recently run by the Federal government.

The government egg car is touring Indiana. This car, in which the United States Department of Agriculture educates the farmers in egg candling, packing and chilling, has just completed a tour over the lines of the Chicago, Indianapolis & Louisville in Indiana. The demonstration car is in itself a complete refrigerating plant on wheels, with its own gasolene engine for operating the refrigerating blowers, which in the course of half an hour can lower the temperature of the cold room to 32 deg. By the aid of models, shippers and railroad men are shown methods of stowing cases in cars so as to minimize damage in transit. Nine per cent of the eggs shipped to New York City alone are now cracked or mashed on the road, an enormous waste which raises the price to the consumer without benefiting the producer in any way. The government has carried out elaborate tests of different methods of stowing, and those that have been found most successful are discussed by the experts in charge. Information is given on the dressing, grading, pre-cooling and packing of poultry.

Cars and Locomotives Ordered in August

The August orders for cars and locomotives showed a considerable increase over the low figures for July. The totals were as follows:

	Locomotives	Freight Cars	Passenger Cars
Domestic	41	3,743	73
Foreign	135	....	15
Totals	176	3,743	88

The foreign orders for locomotives, it will be noticed, were over three times as great in point of numbers as the domestic orders. The foreign orders included among others the following: British Government, 45 narrow-gage locomotives, Baldwin Locomotive Works; Italian State Railways, 60 Consolidation locomotives, American Locomotive Company; and the Northern Railway of Spain, 15 locomotives, American Locomotive Company.

The larger portion of the freight cars ordered were ordered by the New York Central, that road having given orders to the Haskell & Barker Car Company and the American Car & Foundry Company for 1,000 box cars each, and the Standard Steel Car Company for 1,000 gondola cars.

The largest passenger car order was that placed by the New York, New Haven & Hartford, which company authorized the Osgood-Bradley Car Company to proceed with the construction of 60 all-steel coaches.

Real Safety First

Under the date of August 15, E. E. Calvin, president of the Union Pacific, sent the following letter to the employees of the company, emphasizing the importance of the personal element to the success of the safety first movement:

"Safety First implies not alone the elimination of unsafe physical conditions; its attributes are manifold. It is the very eminence of those correlated principles, Responsibility, Sobriety, Morality, Loyalty, Courtesy and Honesty.

"Responsibility: Satisfy yourself that you realize the responsibility which rests upon you personally, and that it is fully and faithfully discharged.

"Sobriety is demanded overwhelmingly on every hand; no one in the railroad world can disregard it.

"Morality is essential to Safety, an attribute that is being required ever more constantly.

"Loyalty is indispensable to your success, and its observance will achieve much for the work you are engaged in.

"Courtesy costs you nothing but a little painstaking effort to make it an element of your character; it can be shown without intrusiveness. There is no better investment for an employee or employer, and certainly nothing else so satisfactory to the public.

"Honesty, not alone in your finances, but in every effort or endeavor. Be honest with yourself.

"Your unfaltering interest in Safety First is earnestly urged, in the hope that by united vigilance and concentrated effort this property will not only maintain its present high standard, but may stand pre-eminently in the foreground at all times in the future."

Railway Strike Ordered for September 4

The scene of activity in the railway wage controversy and the efforts to avert a nation-wide strike of train service employees was transferred to Congress on Tuesday, August 29, when President Wilson went before a joint session of the Senate and House and asked the enactment of legislation not only for the purpose of relieving the present situation, but also as a remedy against the recurrence of similar problems.

This action was taken after the railway executives who had been in Washington for over a week conferring with the President had declined to accept the President's plan that they concede the eight-hour basic day without arbitration, but had offered a counter-proposal providing for an investigation of the questions involved by a special commission, and after the brotherhoods had practically terminated the negotiations without warning by issuing an order calling a strike for the morning of Monday, September 4, Labor Day.

Shortly after the President had presented his message to Congress most of the railway executives who had been in Washington left the city to return to their properties to make preparations for a strike if it should come.

In his address to Congress, President Wilson recommended the following legislation:

Provision for the enlargement and administrative reorganization of the Interstate Commerce Commission.

The establishment of an eight-hour day as the legal basis for both work and wages for railway employees in Interstate commerce. The authorization of the appointment of a special commission to study the results in experience of an eight-hour day, its effect on operating costs and in other aspects, to report to Congress without recommendation.

Approval by Congress of the consideration by the Interstate Commerce Commission of an increase in freight rates to meet the additional expense should the facts justify the increase.

A provision for a public investigation before a strike or lockout may lawfully be attempted.

Lodgment in the hands of the President of power, in case of military necessity, to take control of the railways and to draft into service such train crews and officials as may be required.

In asking for this legislation the President also took occasion to make a public explanation of his course in the controversy.

MEETINGS AND CONVENTIONS

Traveling Engineers' Association.—W. O. Thompson secretary of the Traveling Engineers' Association, has sent out the following circular to all members: "On account of the serious labor conditions that are now in progress with the four Brotherhoods, your executive committee has deemed it wise to postpone the annual convention until a later date. You will be advised in ample time as to what the new date will be."

Master Car and Locomotive Painters' Association.—The next annual convention of the Master Car and Locomotive Painters' Association will be held at Atlantic City, N. J., September 12-14, 1916. The list of subjects to be presented is as follows: The Initial Treatment and Maintenance of Steel Passenger Equipment Roofs, etc.; Headlinings Painted White or in Very Light Shades—How Should They Be Treated and Should They Be Varnished? Is It Economy to Purchase Paints Made on Railroad Specifications; The Shopping of Passenger Cars for Classified Repairs; Railway Legislation and Its Effect on Business.

The following questions will also be discussed: To what extent is it necessary to remove trimmings from passenger car equipment undergoing paint shop treatment? How does the hot water and oil method of cleaning locomotives at roundhouses affect the painted parts? Is there any advantage in painting or oiling the interior of new or old steel gondola and hopper cars? Is there anything superior to varnish remover for removing paint from a steel passenger car, considering labor and material costs? Is there anything superior to soap for the cleaning of passenger equipment cars preparatory to painting and varnishing?

Chief Interchange Car Inspectors' and Car Foremen's Association.—The Chief Interchange Car Inspectors' and Car Foremen's Association will hold its annual convention at Indianapolis, Ind., October 3, 4 and 5, 1916. In addition to a very thorough discussion of the Master Car Builders' Rules and the changes made therein at the June convention of the Master Car Builders' Association, for the purpose of arriving at a uniform interpretation and thereby accelerating the movement of cars through the various interchange points throughout the country, it is anticipated that a number of papers will be read dealing with the subjects of passenger and freight car maintenance, M. C. B. billing, interchange inspection, etc. At this convention will also be decided the winners of the $50 prize offered for the three best papers on Car Department Apprenticeship, these prizes to be awarded $25, $15 and $10, respectively. The committee on the above subject is composed of: W. T. Westall, chairman, New York Central, Collinwood, O.; W. K. Carr, Norfolk & Western, Roanoke, Va.; C. N. Swanson, Atchison, Topeka & Santa Fe, Topeka, Kan.; J. H. Douglas, Wheeling & Lake Erie, Toledo, Ohio, and B. F. Patram, Southern Railway, S. Richmond, Va.

The committee on Freight Car Maintenance is composed of: I. J. Justus, chairman, H. H. Harvey, J. J. Gainey, J. H. Gimple and E. S. Barstow. Papers on this subject will be read by Messrs. Justus, Harvey and Gainey.

There is also a committee on Advanced Methods of Freight Car Repair Billing, and papers on this subject will be read by J. V. Berg, chief M. C. B. clerk, New York Central, Cleveland, O.; L. H. Retan, chief M. C. B. clerk, Ann Arbor Railroad, Owosso, Mich., and F. A. Eyman, chief clerk to superintendent motive power, Elgin, Joliet & Eastern, Joliet, Ill.

Several papers will be read bearing upon the question of Interchange Inspection, the contributors being H. Boutet, chief interchange inspector, Cincinnati, O.; F. T. Rice, chief interchange inspector, Fort Worth, Tex., and A. R. Denney, chief interchange inspector, Binghamton, N. Y.

There will also be papers read on the subject of Passenger Car Cleaning and Sanitation by J. R. Schrader, E. P. Marsh, C. B. Fryer and F. M. Combs.

The association now has a membership of about 500 general foremen, car foremen and interchange inspectors throughout the country and it is anticipated that the constitution and by-laws will be amended so as to admit to membership car inspectors, M. C. B. bill clerks, or anyone actively engaged in the work of the car department.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations:

AIR BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—O. E. Schlink, 485 W. Fifth St., Peru, Ind.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Karpen Building, Chicago.

AMERICAN RAILWAY TOOL, FOREMEN'S ASSOCIATION.—Owen D. Kinsey, Illinois, Central, Chicago.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Sation, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 Lawlor Ave., Chicago. Second Monday in month, except June, July and August, Hotel La Salle, Chicago.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—W. R. McMunn, New York Central, Albany, N. Y. Convention, October 3-5, Indianapolis, Ind.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, C., H. & D., Lima, Ohio.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 547 W. Jackson Blvd., Chicago. Convention, May, 1917, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1126 W. Broadway, Winona, Minn.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Karpen Building, Chicago.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass. Convention, September 12-14, 1916, "The Breakers," Atlantic City, N. J.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—E. N. Frankenberger, 623 Brisbane Building, Buffalo, N. Y. Meetings, third Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio. Convention was to have been held September 5-8, 1917, Hotel Sherman, Chicago. Postponed.

RAILROAD CLUB MEETINGS

Club.	Next Meeting	Title of Paper	Author	Sceretary	Address
Canadian	Sept. 12	Railway Scrap and Salvage.....	E. J. McVeigh...	James Powell	St. Lambert, Que.
Central	Sept. 8	Train Rules and Train Disp.; Annual Outing	John F. Mackie..	Harry D. Vought..	95 Liberty St., New York.
Cincinnati	Sept. 12	System of Railroad Accounting.....	J. T. Leary.....	H. Boutet	101 Carew Bldg., Cincinnati, O.
New England.....	.....	.....	.....	Wm. Cade, Jr.....	683 Atlantic Ave., Boston, Mass.
New York.....	Sept. 17	Railway Clubs and Young Men.....	.....	Harry D. Vought..	95 Liberty St., New York .
Pittsburgh	Sept. 22	.....	G. M. Basford....	J. B. Anderson....	207 Penn Station, Pittsburgh, Pa.
Richmond	Sept. 11	Hudson & Manhattan Subaqueous Tunnel System	.....	F. O. Robinson....	C. & O. Railway, Richmond, Va.
St. Louis	Sept. 8	To Be Selected by Speakers; Entertainment	Executives of Local Lines	B. W. Frauenthal..	Union Station, St. Louis, Mo.
South'n & S'w'rn.	.....	.....	.....	A. J. Merrill.....	Box 1205, Atlanta, Ga.
Western	.....	.....	.....	Jos. W. Taylor....	1112 Karpen Bldg, Chicago.

PERSONAL

GENERAL

M. J. MCCARTHY, superintendent of motive power of the Baltimore & Ohio Southwestern and the Cincinnati, Hamilton & Dayton, at Cincinnati, Ohio, has had his jurisdiction extended over the western lines of the Baltimore & Ohio.

W. H. MALONE, assistant superintendent of locomotive performance of the St. Louis & San Francisco at Springfield, Mo., has been appointed superintendent of locomotive performance, succeeding P. O. Wood, promoted.

J. A. COOPER, supervisor of locomotive service of the Erie at Huntington, Ind., has been appointed inspector of locomotive service, with headquarters at Youngstown, Ohio.

V. B. RANDOLPH, assistant to superintendent of the Erie at Susquehanna, Pa., has been appointed inspector of locomotive service, with headquarters at New York.

C. W. WARNER, assistant general foreman of the Erie at Dunmore, Pa., has been appointed general foreman at that point.

P. O. WOOD, superintendent of locomotive performance of the St. Louis & San Francisco, has been appointed assistant general superintendent of motive power of that road with headquarters at Springfield, Mo.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

A. R. BALDWIN has been appointed master mechanic of the Anthony & Northern, with headquarters at Pratt, Kan. Mr. Baldwin was born at Asheville, N. C., in September, 1874, and began railway service with the Ft. Worth & Denver in 1900, remaining in its employ until 1903, when he entered the service of the Chicago, Rock Island & Pacific. For the past 15 years he has been with the latter company as general foreman of shops at Dalhart, Tex.; Pratt, Kan., and Herington, Kan. His appointment became effective August 15.



A. R. Baldwin

G. W. CUYLER has been appointed master mechanic of the St. Louis and Kansas City terminal divisions of the Chicago, Rock Island & Pacific at Armourdale, Kan., succeeding R. J. McQuade, transferred.

H. CLEWER, whose appointment as master mechanic of the Chicago, Rock Island & Pacific at Trenton, Mo., was announced in the August issue of the *Railway Mechanical Engineer*, was born March 30, 1874, and educated in the public and high schools of Jackson and Athens, Ohio. He entered railway service in 1890 with the Kansas, Ocrola & Southern. After serving some time as engine watchman, machinist helper, foreman and engineman with this road he went to the Chicago & Alton as an engineman and later held the positions of road foreman and master mechanic. In May, 1901, he went to the Rock Island as an engineman and with that road has held the positions of general foreman, superintendent of locomotive operation and engineer of fuel economy. He held the latter position at the time of his appointment as master mechanic.

A. E. DALES, district master mechanic of the Canadian Pacific at Brandon, Man., has been transferred to the Fourth district at Edmonton, Alta., succeeding A. West, transferred to Brandon.

I. H. DRAKE has been appointed master mechanic of the Atchison, Topeka & Santa Fe at Clovis, New Mexico, succeeding H. Schaefer.

W. R. ELMORE has been appointed acting master mechanic of the Nevada Northern at East Ely, Nevada, succeeding H. Selfridge, resigned.

A. K. GALLOWAY, master mechanic of the Baltimore & Ohio at Baltimore, Md., has been appointed general master mechanic of the northwest district and the Cincinnati, Hamilton & Dayton.

H. E. GREENWOOD, master mechanic of the Baltimore & Ohio Southwestern at Seymour, Ind., has been made master mechanic at Chillicothe, Ohio, succeeding P. H. Reeves.

W. F. HARRIS, general foreman of the Baltimore & Ohio Southwestern at Storrs, Ohio, has been appointed master mechanic at Flora, Ill.

J. HAWKINS has been appointed road foreman of engines of the Canadian Northern at Rideau Jct., Ont.

W. N. INGRAM has been appointed acting master mechanic, District 5, of the National Transcontinental at Edmundston, N. B.

A. J. IRONSIDES, formerly district master mechanic of the Canadian Pacific at Edmonton, Alta., has been appointed district master mechanic at Winnipeg, Man., succeeding G. Twist, transferred.

T. W. MCCARTHY, master mechanic of the Kansas division of the Chicago, Rock Island & Pacific at Horton, Kan., has been appointed master mechanic in charge of shops at Horton.

R. J. MCQUADE has been appointed master mechanic of the Kansas division of the Chicago, Rock Island & Pacific at Herington, Kan., succeeding T. W. McCarthy, transferred.

J. E. QUIGLEY, master mechanic of the Baltimore & Ohio Southwestern at Flora, Ill., has been made master mechanic at Seymour, Ind., succeeding H. E. Greenwood.

JOHN L. SMITH, JR., has been appointed master mechanic of the Pittsburg & Shawmut at Brookville, Pa.

G. TWIST, district master mechanic of the Canadian Pacific at Winnipeg, Man., has been appointed district master mechanic at Medicine Hat, Alta., succeeding A. West, transferred.

A. WEST, formerly district master mechanic of the Canadian Pacific at Medicine Hat, Alta., has been appointed district master mechanic at Edmonton, Alta., succeeding A. J. Ironsides, transferred.

THOMAS WINDLE has been appointed acting master mechanic of the Midland Valley Railway, at Muskogee, Okla., succeeding C. D. Powell, resigned.

F. C. WALLACE, general foreman of the Erie at Dunmore, Pa., has been appointed master mechanic at Avon, N. Y.

C. H. NORTON, master mechanic of the Erie at Avon, N. Y., has been transferred as master mechanic to Susquehanna, Pa.

CAR DEPARTMENT

W. T. COUSLEY has been appointed division car foreman of the Galveston, Harrisburg & San Antonio, at El Paso, Tex., succeeding H. Allen, resigned. Mr. Cousley was formerly master car builder of the San Antonio & Aransas Pass.

JOHN H. SCHROEDER has been appointed foreman of pas-

senger car repairs of the Delaware, Lackawanna & Western at Kingsland, N. J. He entered the service of the Lackawanna 25 years ago as a car repairer in the Scranton freight car shops, remaining there about 4 years. He was then transferred to the passenger car department and was later made car foreman at Kingston, Pa., for a short time. He returned to the Scranton shops, and in September, 1901, was appointed freight car foreman at Secaucus, N. J., remaining in that position until his appointment to his present position at Kingsland. While at Secaucus Mr. Schroeder took an active interest in the work of the Railroad Y. M. C. A., serving as a member of the committee of management. He is at present chairman of that committee and is also a member of the Board of Education of Lyndhurst, N. J., where he resides.

SHOP AND ENGINEHOUSE

C. S. Blackwell has been appointed foreman of the Atchison, Topeka & Santa Fe at Deming, New Mexico, succeeding W. H. Kushera.

D. D. Coleman, general foreman of the Erie at Jersey City, N. J., Southside roundhouse, has been appointed assistant to the master mechanic at Jersey City.

A. J. Davis, general foreman of the Erie at Hornell, N. Y., has been appointed assistant to the master mechanic at Hornell.

E. T. Du Pue, shop superintendent of the Erie at Galion, Ohio, has been transferred to Susquehanna, Pa., in the same capacity.

L. M. Granger, general foreman of the Erie at Susquehanna, Pa., Outside Terminal, has been appointed general foreman of the Southside roundhouse of that road at Jersey City, N. J.

William Gruys has been appointed foreman of the Atchison, Topeka & Santa Fe, at Waynoka, Okla., succeeding J. J. Wagner.

H. H. Harrington, shop superintendent of the Erie at Susquehanna, has been transferred to Galion, Ohio, in the same capacity.

H. A. Hillman, roundhouse foreman of the Erie at Cleveland, Ohio, has been appointed general foreman at Hornell, N. Y.

H. C. Huckins, formerly roundhouse foreman on the Chicago & Eastern Illinois, has been appointed general foreman of that road at Salem, Ill.

S. Illingsworth, formerly night locomotive foreman of the Canadian Pacific at Lambton, Ont., has been appointed locomotive foreman at MacTier, Ont., succeeding C. A. Wheeler, transferred.

A. R. Piper has been appointed division foreman of the Atchison, Topeka & Santa Fe at San Marcial, New Mexico, succeeding A. H. Bierne.

E. P. Poole has been appointed supervisor of tool equipment and piecework of the Baltimore & Ohio, with headquarters at Baltimore, Md., and the position of supervisor of machine and hand tools has been abolished.

T. T. Ryan has been appointed foreman of the Atchison, Topeka & Santa Fe at Las Vegas, New Mexico, succeeding T. G. Evans.

M. F. Scott, formerly charge hand in the erecting shop of the National Transcontinental, has been appointed foreman of the erecting shop at Transcona, Man.

C. A. Wheeler, formerly locomotive foreman of the Canadian Pacific at MacTier, Ont., has been appointed locomotive foreman at Ottawa, Ont.

PURCHASING AND STOREKEEPING

W. F. Castle has been appointed storekeeper of the San Antonio, Uvalde & Gulf, with office at North Pleasanton, Tex., succeeding G. F. Williams, resigned.

George K. Russell has been appointed general storekeeper of the Pittsburg & Shawmut at Kittanning, Pa.

T. N. Souter has been appointed storekeeper of the Southern Pacific, with headquarters at Houston, Tex., succeeding R. L. Preis, deceased.

G. F. Williams has been appointed general storekeeper of the Midland Valley Railway, with headquarters at Muskogee, Okla.

OBITUARY

Colonel William P. Clough, chairman of the board of directors of the Northern Pacific, died at his home in New York on August 18.

William Wratten, who retired as district master mechanic of the Chicago, Milwaukee & St. Paul at Minneapolis, Minn., in September, 1913, died at that city on July 28.

NEW SHOPS

Boston & Maine.—A contract is reported let by the Boston & Maine, for building a new locomotive shop at East Deerfield, Mass.

Canadian Northern.—This company has commenced the construction of a machine shop and stores building at Edmonton, Alta. The machine shop will be a one-story structure, 61 ft. by 118 ft., with brick walls and concrete foundation. The stores building will be two stories in height, 86 ft. by 48 ft., with brick walls and concrete foundation.

Chicago, Milwaukee & St. Paul.—This company contemplates the construction of terminal facilities at Atkins, Iowa. The improvements will include a 26-stall roundhouse, 90-ft. turntable, 154-ft. cinder pit, a coal handling plant, a power house 50 ft. by 80 ft., a blacksmith and machine shop 50 ft. by 90 ft., a storehouse 50 ft. by 100 ft., an ice house and other buildings, as well as a modern yard for handling increased traffic.

Chicago, Milwaukee & St. Paul.—This company has commenced the construction of new terminal facilities at South Beloit, Ill. The work includes the construction of a three or four-stall engine house, with an 80-ft. turntable, a 43-ft. cinder pit, a coaling plant, a power house, 18 ft. by 32 ft., and a water tank.

Chicago, Milwaukee & St. Paul.—This company has started the construction of extensive terminal facilities including a 22-stall roundhouse, a 90-ft. turntable, a 100,000-gal. water tank, a 154-ft. cinder pit, a sand house, a coaling station, a power house, 50 ft. by 63 ft., a blacksmith and machine shop, 40 ft. by 60 ft., a car repair building, 40 ft. by 80 ft., and an entirely new yard layout, involving 15 miles of track at North McGregor, Iowa.

Duluth & Iron Range.—This company has commenced the construction of a new car repair shop, one story high, 275 ft. wide and 298 ft. long at Two Harbors, Minn. The shop will be of mill building construction with steel frame, concrete block wall, concrete mastic floor and pitch and gravel roof.

Erie Railroad.—This company is carrying out improvements on the County road at Secaucus, N. J. The work calls for the construction of a 36-stall roundhouse, to have 115-ft. stalls and a 100-ft. turntable, a machine shop, a power house, a storehouse and a complete engine terminal. The foundations of the buildings will be of concrete. The superstructures

of the roundhouse and machine shop will be of frame construction and the power house of tile.

GRAND TRUNK.—This company has started work on new repair shops at Port Huron, Mich. There will be eight buildings in the group, which are intended to accommodate 30 passenger and 75 freight cars at one time.

LEHIGH VALLEY.—The present inadequate engine handling facilities of the Lehigh Valley at Manchester, N. Y., will be replaced with a 30 stall roundhouse, for which contract has been let to Westinghouse, Church, Kerr & Co., New York. The company will also carry out improvements, including the construction of a new machine shop, boiler, engine and oil houses and also a 100 ft. turntable and special electrical apparatus will be provided to operate all of the machinery and light the yards.

LEHIGH VALLEY.—Terminal improvements are to be carried out by the Lehigh Valley at Niagara Falls, N. Y., to include a new 15-stall roundhouse, machine shop, storehouse, engine, boiler and oil house. A new car repair yard with necessary shops and storehouses will be built. The new roundhouse will be of modern type and will be of steel and reinforced concrete construction. The improvements include drop pits and a washout system for cleaning engines, a concrete and steel water ash pit, double tracked and 250 ft. long, and a concrete and steel coal pit 200 ft. long with elevated tracks. A 100 ft. turntable will also be built.

NEW YORK, NEW HAVEN & HARTFORD.—This company will ask for bids as soon as plans are completed for the construction of a roundhouse, also a shop and an office building at White Street yard, Danbury, Conn. The buildings are to be of frame construction with terra cotta fire wall. The roundhouse will contain eight 95-ft. stalls; the shop is to be one story high, 48 ft. by 100 ft., and the office building is to be two stories high, 42 ft. 6 in. wide by 49 ft. 8 in. long. In addition there will be a boiler and generator room, 48 ft. by 48 ft.; a storeroom, 36 ft. by 48 ft., with an oil storage system.

OREGON SHORT LINE.—This company will erect a five-stall addition to its roundhouse at Glenn's Ferry, Idaho.

PENNSYLVANIA RAILROAD.—This company will start work shortly on a 14-stall roundhouse at Derry, Pa. The structure will be of brick and wood, and will have a wood block floor, wood rolling doors and built up roofing.

PENNSYLVANIA RAILROAD.—This company will use its own forces to build an extension to its enginehouse at Renovo, Pa., including a small enginehouse office building. The addition will be built of concrete and brick with a timber and asphalt roof.

MEASURING POWER OF STEAM TURBINES.—In steam turbines, the indicator cannot be employed, as the movement of the buckets and the flow of steam are continuous. The mechanical power developed at the shaft is measured by using a friction or Prony brake or electric generators or other loads that are ascertainable.—*Power.*

STEEL EXPORTS.—Exports of ingots, billets and blooms, according to figures compiled by the Bureau of Statistics, have grown at such a rate that 1,000,000 tons per year have been reached. With an increase from 50,942 tons per month in the last quarter of 1915 to 84,770 tons per month for the first four months of 1916, the outgo has reached the record rate of 1,017,240 tons per year.—*American Machinist.*

STRENGTH OF FOLLOWER BOLTS.—Follower bolts lose their strength by crystallization caused by alternate cooling and heating and are likely to fracture when comparatively small strains are brought to bear. To be on the safe side, careful engineers make a practice of renewing these bolts at certain intervals.—*Power.*

SUPPLY TRADE NOTES

E. W. Richey has been appointed assistant to the president of the Standard Forgings Company, with office at Chicago, Ill.

Walter D. Thomas, for many years representative in the southeastern states for the Rodger Ballast Car Company, Chicago, died July 10.

G. A. Trube has been appointed export manager of the Westinghouse Air Brake Company and the Westinghouse Traction Brake Company at Pittsburgh, Pa.

W. H. Stocks, sales representative at Chicago for the Gold Car Heating & Lighting Company, New York, died in Chicago on August 15, following an illness of several months. Mr. Stocks had been in the service of the company for over 13 years.

The St. Louis offices of the Westinghouse Air Brake Company and Westinghouse Traction Brake Company, C. P. Cass, southwestern manager, have been removed from the Security building to Suite 1407-1415 Boatmen's Bank building, St. Louis, Mo.

Thornton Hopkins, connected with the Beckwith-Chandler Company, New York, manufacturers of high grade varnishes, for many years as a representative in the railway department, and subsequently as assistant secretary, died at his home in Brooklyn, N. Y., July 31.

The Ellcon Company, 50 Church street, New York, announces the appointment of Wm. Wampler as eastern sales manager of the Acme Supply Company, Chicago. This appointment will in no way affect Mr. Wampler's interest and activity as vice-president and general manager of the Ellcon Company.

W. Sharon Humes, formerly employed in the motive power department of the Pennsylvania at Altoona, Pa., and later sales manager of the General Railway Supply Company at Chicago, has become associated with the Hewitt Company, Chicago, in the manufacture and sale of anti-friction metals and locomotive packing.

A. C. Garrison has been elected president of the Corrugated Bar Company, St. Louis, Mo., to succeed his father, D. E. Garrison, deceased. A. L. Johnson has been appointed vice-president and general manager, and W. H. Kennedy, vice-president and treasurer. W. M. Armstrong, vice-president and sales manager, has resigned.

Frank J. Engel, recently with the Boston & Albany, and Herman P. Hevenor, recently with the New York, New Haven & Hartford, and previously with the Brooklyn Rapid Transit, have formed a copartnership for carrying on an engineering and contracting business, operating under the firm name of Engel & Havenor, with officers at 220 Broadway, New York.

The Acme Supply Company, Chicago, announces the opening of its own offices in eastern and southeastern territory. William M. Wampler has been appointed eastern sales manager, and Franklin M. Nicholl, eastern and Canadian sales representative, with headquarters at 50 Church street, New York City. F. N. Grigg has been appointed southeastern sales manager, with headquarters in the Virginia Railway & Power building, Richmond, Va. E. S. Sullivan has been appointed sales representative, with headquarters at the Monadnock building, San Francisco, Cal.; W. F. McKenney, sales representative, with headquarters at 54 First street, Portland, Ore., and Bell & Jamison, sales representatives, with headquarters in the Hellman building, Los Angeles, Cal.

Harry M. Evans has been appointed assistant western sales manager of the Franklin Railway Supply Company, with office in the McCormick building, Chicago. Mr. Evans was born at Meadville, Pa., and was educated in the public schools at that place. He began railroad work as a call boy on the Erie, and served in various positions in the mechanical, transportation and traffic departments of that road. He entered the mechanical department of the Franklin Railway Supply Company October 1, 1908, as traveling representative, which position he held until his recent promotion to the sales department, as noted above.

Charles M. Terry, Inc., of Sydney, Australia, announces that it has secured the services of C. M. Barron as consulting and purchasing engineer, to be located in the company's offices, 23 Beaver street, New York. Mr. Barron has for the past five years exerted his efforts studying and cultivating the Australasian market for railway supplies, machine tools and raw materials.

Harrison Railways Specialties Company

The Harrison Railways Specialties Company, incorporated in the state of Ohio, has acquired by purchase the business and good will of the Harrison Dust Guard Company, Toledo, Ohio, formerly owned by Frank B. Harrison, who has severed his connection with the organization. The head executive office of the new company will be at Sandusky, Ohio, and the general sales office at 628-629 McCormick building, Chicago, Ill. Among the devices manufactured by the company are dust guards, journal boxes, car journal lubricators, locomotive cellars, locomotive cellar lubricators. The officers of the new pany are as follows: J. J. Dauch, president; Sidney Frohman, vice-president; W. N. Thornburgh, vice-president and general manager; Frank Kennison, treasurer, and W. P. Rude, secretary and assistant treasurer. Messrs. Dauch, Frohman and Rude will have headquarters at Sandusky, Ohio; Mr. Kennison at Toledo, Ohio, and Mr. Thornburgh at Chicago, Ill. J. J. Dauch is president of the Hinde & Dauch Paper Company, the Dauch Manufacturing Company and the Waycleanse Company, and a director of the Frohman Chemical Company, Sidney Frohman has been treasurer of the Hinde & Dauch Paper Company for many years. He is also president and treasurer of the Frohman Chemical Company, treasurer of the Dauch Manufacturing Company, and a director and officer of various other corporations. Previous to entering business, Mr. Thornburgh was in the service of the Baltimore & Ohio successively as telegraph operator and chief clerk in the operating and traffic departments. Since leaving the Baltimore & Ohio he has been consecutively district manager of the Cleveland Stone Company at New York, Boston and Chicago; manager and treasurer of the Thornburgh Coupler Attachments Company, Ltd., Detroit, Mich; vice-president of the Ohio Quarries Company, Cleveland, Ohio; vice-president and general manager of the Metropolitan Engineering and Construction Company, Kansas City, Mo.; general manager of sales of the Standard Asphalt & Rubber Company, Chicago, Ill.; a member of the firm of Thornburgh & Kinnear, general contractors, Houston, Tex., and manufacturers' representative in the brick, stone and marble business at Pittsburgh, Pa. Mr. Thornburgh will have charge of the general sales office at Chicago, Ill.



J. J. Dauch



S. Frohman



W. N. Thornburgh

T. F. Flanagan, whose appointment as general sales and advertising manager of the Pyrene Manufacturing Company, New York, has already been announced in these columns, is only 25 years of age. He was educated at Trinity College in Hartford, where he was active in the management of both the college magazine and newspaper. During the same time he worked nights as a reporter on the Hartford Courant, and during the summer did police reporting. Following his graduation, Mr. Flanagan went to New York and became associated with the Wales Advertising Agency, which he left to become advertising manager of the C. J. Tagliabue Manufacturing Company, in Brooklyn. In that company, he worked rapidly into the sales department, where he directed the work of about 20 salesmen and where he remained until 14 months ago, when he joined the Pyrene Manufacturing Company as assistant advertising manager. Soon after he joined the Pyrene forces he became assistant to C. Louis Allen, now the company's president, but then its sales manager, and when Mr. Allen's promotion left the position of head of the sales force vacant the work devolved on Mr. Flanagan. Now he has been given the title of general sales and advertising manager as above noted.



T. F. Flanagan

J. L. Terry has become associated with the sales department of the Q & C Company, New York. Mr. Terry has been in railway supply work but a comparatively short time. He was formerly on the Denver & Rio Grande, and later purchasing agent of the Denver, Laramie & Northwestern,

and subsequently served as superintendent and general manager.

The Chicago office of the Ashton Valve Company, Boston, Mass., will be located in the Transportation building on and after September 1.

Walter Chur, president and general manager of the American Railway Supply Company, New York, died August 29 at his home in East Orange, N. J., after an illness of five months, of heart disease.

The Waynesboro Foundry & Machine Company, Waynesboro, Pa., is contemplating installing a new line of foundry equipment for the manufacture of a brass specialty. The company operates a brass, bronze and aluminum foundry.

The Selby Safety Flag Company, St. Louis, Mo., is in receipt of orders from the Chicago, Peoria & St. Louis, the Southwestern (Texas), and the Kansas City, Mexico & Orient, for improved flagmen's signal outfits.

W. L. Hayes, formerly assistant manager of the Cleveland, Ohio, district of the American Steel & Wire Company, has been appointed manager of the Chicago district, to succeed F. C. Gedge, deceased. W. C. Stone, formerly assistant manager of the Chicago district, has been appointed manager of the Cleveland, Ohio, district to succeed Mr. Hayes.

At the recent annual meeting of the stockholders of the United States Light & Heat Corporation, Niagara Falls, N. Y., the following board of directors were elected: Egbert H. Gold, J. Allan Smith, Ralph C. Caples, Henry W. Farnum, A. Henry Ackermann, Chauncey L. Lane, Keene H. Addington, James A. Roberts, Conrad Hubert, George G. Shepard, Edwin K. Gordon. The vote of confidence in favor of the present management was 371,079 out of 425,245 votes cast.

Edwin L. Willson, for the past five years sales engineer in charge of the railroad department of the Hazard Manufacturing Company, Wilkes-Barre, Pa., resigned on August 1 to become president of the Connecticut Electric Steel Company, Inc. Mr. Willson was born at Baltimore and received his early education in the public schools of that city. In 1905 he graduated from the Baltimore Polytechnic Institute and in 1908 graduated from Lehigh University with the degree of electrical engineer. During his school days he was engaged in railway engineering and construction work with the Westinghouse Electric & Manufacturing Company. Upon leaving school he went with the Hazard Manufacturing Company, at the Wilkes-Barre office, in charge of electrical and chemical testing. In July, 1911, he entered the sales department as sales engineer in charge of railroad work, with offices in New York City, which position he held until August 1. In his new position Mr. Willson has headquarters at 50 Church street, New York, but will shortly remove his office to Hartford, Conn., at which point the foundry is located. The plant is nearing completion and will be in operation early in Octoebr. The Connecticut Electric Steel Company, Inc., will manufacture high quality steel castings by the Heroult electric process.



E. L. Wilson

CATALOGUES

AIR COMPRESSORS.—Bulletin 34-N recently issued by the Chicago Pneumatic Tool Company deals with the company's steam and power driven single compressors.

SCALES.—The Standard Scale & Supply Company, Pittsburgh, Pa., in its recently issued price list No. A210, gives illustrations, brief descriptions and price lists of the line of Standard scales. The scales shown include a wide variety for many kinds of businesses and uses.

STORAGE BATTERIES.—One of the latest publications of the Electric Storage Battery Company, Philadelphia, bulletin No. 159, deals with the Ironclad-Exide battery for storage battery, mine and industrial locomotives. The booklet describes the batteries themselves and contains a score of views of storage battery locomotives.

FOUNDRY EQUIPMENT.—The Whiting Foundry Equipment Company, Harvey, Ill., has recently issued catalog No. 120, dealing with tumblers and dust arresters; catalog No. 121, dealing with coke oven equipment, including ovens, racks, cars, trucks and coke-oven doors, and catalog No. 122, dealing with ladles. All three bulletins are well illustrated.

CAR WHEELS.—The Griffin Wheel Company has issued a seven-page booklet containing nine reasons why the chilled iron car wheel is preferable to other types of wheels, as follows: safety, low initial cost, low maintenance cost, guaranteed service, brake efficiency, saving in brake shoes, saving in rail wear, minimum of flange wear and liberal allowance for old wheels.

STRUCTURAL TIMBER.—The National Lumber Manufacturers' Association has issued a 70-page book by C. E. Paul on heavy timber mill construction buildings. The book describes mill construction, and the manner in which it is built and gives information concerning the cost. The book should be of much value to those interested in this character of construction.

PASSENGER CAR COUPLERS.—The McConway & Torley Company, Pittsburgh, Pa., has recently issued a booklet dealing with its Pitt pivoted passenger coupler. The booklet describes the coupler, particular attention being given to its great flexibility in curving, and contains views of 45 passenger cars of various types, for 16 different roads, on which the Pitt coupler was specified.

LOCOMOTIVE STOKERS.—The Locomotive Stoker Company has recently issued catalogue 14-C, dealing with Street locomotive stoker applications. The book in its 60 pages shows the different types of locomotives to which these stokers have been applied, there being given photographs and specifications of 28 locomotives of different types built for 15 railroads. This is the fourth revision of this catalogue and brings it up to date.

THE LOGIC OF THE DEAN.—This is the title of a booklet which has recently been issued by the William B. Pierce Company, Buffalo, N. Y. The booklet deals with the Dean boiler tube cleaner made by the company. It shows how scale is formed and asserts that the formation of scale cannot be prevented absolutely by boiler compounds. It then takes up the problem of scale removal and describes the Dean tube cleaner and its operation. A list of users is also given.

STEEL PIPE.—The National Tube Company has recently issued a third edition of its catalog of National Matheson joint pipe. This is a system of piping for high or low pressure natural or artificial gas lines, water works, mines, mining, hydro-electric plants, irrigation and engineering uses. The catalogue takes up the characteristics of the pipe and shows its advantages for different kinds of service. The book is extremely well illustrated with views of typical installations of

many different kinds. One of the interesting features is a series of drawings or cartoons emphasizing some of the points that are made in the text.

Pyrometers.—The Gibb Instrument Company, Pittsburgh, Pa., has issued a folder relative to the "I-Rite" for judging the temperature of metal undergoing treatment. The "I-Rite" is an instrument in appearance much like a pocket flashlight. The person using it stands some distance from the furnace, and looks through it at the object the temperature of which is to be measured. A description of it appeared in the May, 1916, *Railway Mechanical Engineer*, page 262.

Wood Construction and Fire Losses.—The National Lumber Manufacturers' Association, Chicago, has issued a 15-page booklet pointing out some of the errors in the commonly accepted ideas regarding the large fire losses resulting from timber construction and presenting a large amount of data regarding actual accurate comparisons. This book contains a large amount of information of value to those interested in wood construction from the standpoint of the fire hazard.

Gear Blanks and Miscellaneous Circular Sections.—The Carnegie Steel Company has recently issued a third edition of its booklet dealing with this subject. The booklet contains standard specifications, lists of dimensions, illustrations and drawings of forged and rolled gear blanks, industrial and mine car wheels, street and interurban railway wheels, pipe flanges and shaft couplings, automobile flywheel blanks, crane track wheel blanks and piston blanks. The piston blanks for the manufacture of solid steel locomotive pistons are illustrated for the first time.

Steam Hammers.—The National Hoisting Engine Company, Harrison, N. J., has issued a 20-page catalog describing the National steam pile hammer. The booklet contains tables giving the dimensions and other characteristics of the five sizes of these hammers and is illustrated with photographs showing the hammers in use on various kinds of construction work. A 12-page pamphlet has also been issued describing the steam hammers No. 6 and No. 7, weighing 650 and 150 lb., respectively, which are designed especially for use in driving wood and steel sheet piling.

Coal Unloader.—The Roberts & Schaefer Company, Chicago, has issued Bulletin No. 31, which describes the "RandS" measuring coal loader for locomotives, a device which automatically measures the coal as it is being discharged into the locomotive tenders. The operation of this device is explained in detail with ample illustrations. The pamphlet also contains a description, with illustrations, of the duplex 12-ft. shallow pit loader, a new arrangement of the substructure of coaling stations which will decrease the cost of foundations for any coaling station of the bucket type.

On the Firing Line with Battery Bill.—The story of W. Alkaline Battery, otherwise known as Battery Bill, has now been published in booklet form by Battery Bill's employer, the Edison Storage Battery Company, Orange, N. J. Battery Bill is already well known to readers of the advertising pages of the *Railway Mechanical Engineer*. He is the enterprising salesman of Edison storage batteries whose adventures, detailed in the form of letters to his boss, center around his successful attempt to sell Edison batteries to the X. Y. Z. Railroad and to help the officers of that road answer the query of President X: "Why aren't we using Edison batteries?"

Heating and Ventilating Apparatus for Passenger Cars.—This is the title of a 144-page book, 9 by 12 in. in size, which has recently been issued by the Gold Car Heating & Lighting Company, New York. The book gives a complete description of the company's steam, vapor, hot water and electric systems for heating and automatically controlling the temperature of all types of railway cars, and also data concerning its ventilators. The apparatus which is included in the systems is illustrated and described in detail, and drawings are given, many of them in two or more colors, showing the application of each of the various systems.

Car Curtains and Curtain Fixtures.—The Acme Supply Company, Chicago, has issued Bulletin F-6, in which is introduced its new Acme Enclosed Groove F. P. Curtain Fixture No. 100. The interesting point in this fixture is the fact that it cannot be removed from its groove by the passengers. No pinch handles are required, and it can be operated from any point along the bottom of the curtain. Descriptions of the Crown and Gem curtain fixtures for use with open grooves, the Acme friction roller, and the special metal car curtain roller, are also contained in this bulletin as well as curtain fixtures for electric cars and interurban coaches.

Varnishes, Enamels and Japans.—The Moller & Schumann Company, Brooklyn, N. Y., has recently issued Bulletin No. 1, dealing with the company's Hilo black enamels and japans. The bulletin describes the range of blacks available for wood, steel, cast iron, tin, brass or other materials. It contains lustre standards whereby one may readily obtain a clear idea of the meaning of the terms, gloss, semi-gloss, rubber, dull rubber or flat, and be enabled to pick out the finish best suited to his needs. Each article is described in a manner to indicate its use. The bulletin also gives the necessary reduction for applying; the various methods of brushing, spraying, dipping and tumbling, and it also indicates the heat and time of baking.

Car Wheels.—The American Steel Foundries have issued an attractive catalog descriptive of the Davis steel wheels made by the company. The booklet names the advantages of the Davis one-wear steel wheel asserting that, "It retains the advantages of the cast iron wheel—a hardened tread and flange, a softer plate and hub, and a one-wear construction" and in addition is stronger, is of less weight, has absolute rotundity because of its ground treads and has a lower maintenance cost on account of fewer removals for common wheel defects. The booklet is well illustrated, there being given sections, pictures of the wheels, and a number of views, some in colors, showing the manufacture. One section deals with wheels for electric railway service and another gives comparative data of Davis and other wheels in tests and actual service.

Standard Safety Devices.—The "Conference Board on Safety and Sanitation," 928 Western avenue, West Lynn, Mass., has issued an eight-page leaflet describing the "N. A. S. O." safety devices, with illustrations and prices. These devices have been approved by the Conference Board, which represents the National Affiliated Safety Organizations, namely, the National Founders' Association, the National Association of Manufacturers, and the National Metal Trades Association; and all of the articles are made under the supervision of the board. The aim is to sell these articles at cost, or nearly so; but any profits derived from sales are utilized for further research in connection with the promotion of safety in industrial establishments. Among the things described are goggles; leggins for foundrymen; respirators; the N. A. S. O. Sanitary Stretcher; Safety Feet for Ladders, and a Metal Danger Sign.

French Metal and Timber Committee.—By virtue of a decree dated June 11, 1916, a committee has been appointed at the French Ministry of War to centralize the acquisition of metal and timber from abroad and to distribute the material imported, together with that of French production, to the best interests of national defence. The members of the committee are taken from the various Ministries and from various military and naval corps.—*Engineering.*